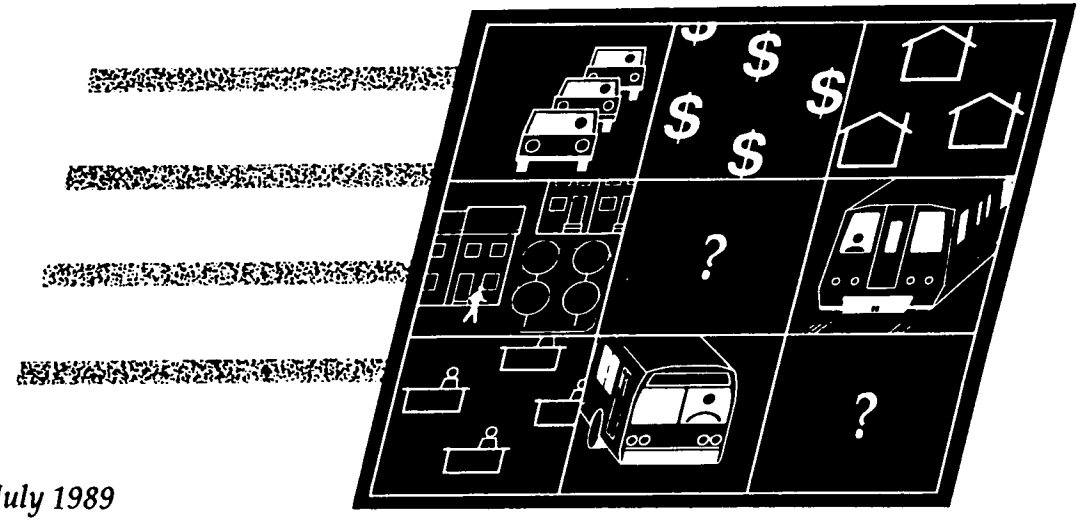
APPENDICES:
Background Information



July 1989

Volume 4

Montgomery County
Comprehensive Growth Policy Study

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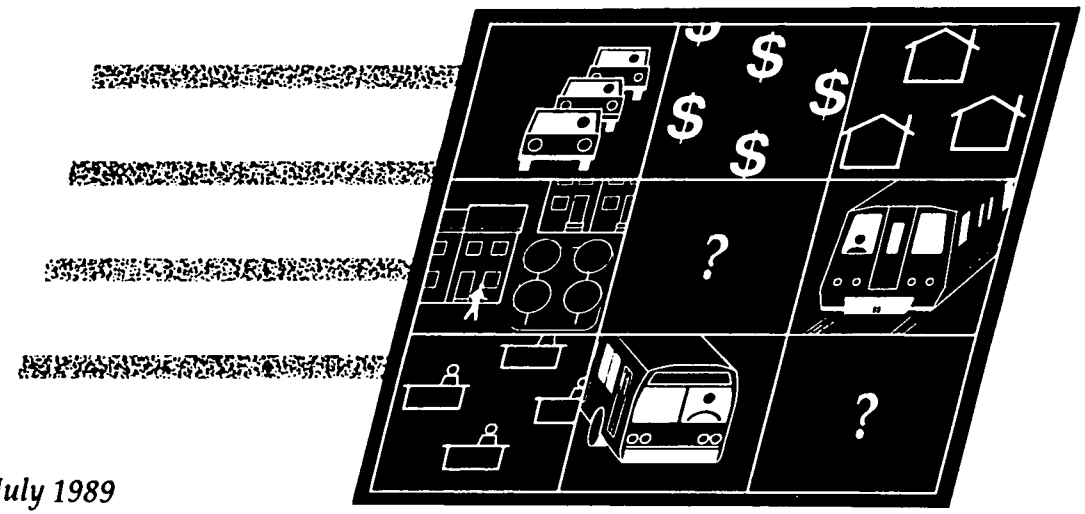

July 1989

Volume 4

Montgomery County
Comprehensive Growth Policy Study

ABSTRACT

Title:	Comprehensive Growth Policy Study Volume 4. APPENDICES: Background Information
Author:	Montgomery County Planning Department The Maryland-National Capital Park and Planning Commission
Subject:	Supporting information referred to in the course of developing this study
Date:	July 1989
Planning Agency:	The Maryland-National Capital Park and Planning Commission
Source of Copies:	The Maryland-National Capital Park and Planning Commission 8787 Georgia Avenue, Silver Spring, Maryland 20910-3760
Number of Pages:	47
Abstract:	This document contains a wide range of resource data and information used in the development of the scenarios, the assessment models, and the conclusions of this study.

The Maryland-National Capital Park and Planning Commission

The Maryland-National Capital Park and Planning Commission is a bi-county agency created by the General Assembly of Maryland in 1927. The Commission's geographic authority extends to the great majority of Montgomery and Prince George's Counties: The Maryland-Washington Regional District (M-NCPPC planning jurisdiction) comprises 1,001 square miles, while the Metropolitan District (parks) comprises 919 square miles in the two counties.

The Commission has three major functions:

(1) the preparation, adoption, and, from time to time, amendment or extension of the General Plan for the physical development of the Maryland-Washington Regional District;

(2) the acquisition, development, operation, and maintenance of a public park system; and

(3) in Prince George's County only, the operation of the entire County public recreation program.

The Commission operates in each county through a Planning Board appointed by and responsible to the county government. All local plans, recommendations on zoning amendments, administration of subdivision regulations, and general administration of parks are responsibilities of the Planning Boards.

ELECTED AND APPOINTED OFFICIALS

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Isiah Leggett, President Pro Tem
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Rose Crenca, Council Member
Neal Potter, Council Member
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COUNTY EXECUTIVE

Sidney Kramer

THE MARYLAND-NATIONAL CAPITAL PARK AND PLANNING COMMISSION COMMISSIONERS

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Planning Board

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Appendix 1

List of Master Plan of Highways Projects

List of Master Plan of Highways Projects

APPENDIX 1

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Map Number	Project Name	Project Limits	Type of Road: County St-Sec St-Prim St-Inter	Master Plan of Highways Number	Planning Area	Number of Lanes per Direction: Existing v	Ultimate v	Ultimate # of Lanes v	Diff # of lanes: Ult.vs CIP	Type of Construction: 1-New Road 2-Reconstruction 3-Widening/ Resurfacing	Is Road in 5th or 6th Years of CIP?
	County Roads [(Beyond 100% Funds Expended in the 5th & 6th Year of the CIP) or (Listed in the Master Plan)]										
1	Good Hope (North) Road	Good Hope Rd to MD 198	County	P000	Cloverly	0	0	1	1	Reconstruction	Yes
2	Redland (North) Road	Needwood Rd to MD 115	County	P000	Gaith(East)	0	0	1	1	Reconstruction	Yes
3	Seven Locks Road	River Rd to Dwight Dr	County	P000	Potomac	0	0	1	1	Reconstruction	Yes
4	Waring Station Road	MD 117 to CSX Tracks	County	P000	Germ (West)	1	1	2	1	Reconstruction	Yes
5	"New Road" (P-2)	Dorsey Rd(P-4) to Fieldcrest Rd	County	P002	Rock Creek	0	0	1	1	New	No
6	Cashell Road Extended	Bowie Mill Rd to MD 108	County	P005	Rock Creek	0	0	1	1	New	No
7	Spartan Rd Extended (P-5)	Pr Philip Dr to Old Baltimore Rd Ext	County	P005	Olney	0	0	1	1	New	No
8	Bells Mill Road	Gainsborough Rd and Seven Locks Rd	County	P010	Potomac	0	0	1	1	Reconstruction	No
9	Old Baltimore Rd Extended	MD108 to Gold Mine Rd	County	P013	Olney	0	0	1	1	New	No
10	Westminster Drive	MD108 to Batchellor's Forest Rd	County	P015	Olney	0	0	1	1	New	No
11	Batchellor's Forest (P-15)	Georgia Ave to Westminster Dr	County	P015	Olney	0	0	1	1	New	No
11	Batchellor's Forest (P-16)	Westminster Rd to Dr Bird Rd	County	P016	Olney	0	0	1	1	New	No
12	Gainborough Road	Tuckerman Rd to Seven Locks Rd	County	P017	Potomac	0	0	1	1	Reconstruction	No
13	Burdette or Piedmont Road	MD 121/Burnt Hill Rd to MD 27	County	P/A257	Clarksburg	1	1	2	1	Reconstruction	No
14	Crystal Rock Road (B-1)	Old Germantown Rd to New Rd (A-74)	County	B002	Germ (West)	0	0	2	2	New	No
15	Wisteria Dr (B-2) (Widen)	Old Germnt'n Rd to Germnt'n Rd Reloc	County	B002	Germ (West)	1	1	2	1	Widening	No
15	Wisteria Drive (B-2) (New)	Germnt'n Rd Reloc to Fthr Hurley Blvd	County	B002	Germ (West)	0	0	2	2	New	No
16	Lewis Drive (B-6)	Ridge Rd(B-2) and Ridge Rd(B-5)	County	B004	Damascus	0	0	1	1	New	No
17	Spartan Rd Extended (B-5)	MD 108 to Prince Philip Dr Ext(A-46)	County	B005	Olney	0	0	1	1	New	No
18	Tech Road	Columbia Pike to southwards	County	B006	Fair-Belts	1	1	2	1	Reconstruction	No
19	Blueridge Avenue	Georgia Ave to Amherst Ave	County	B???	Ken/Wheaton	1	1	2	1	Widening	No
20	Grandview Avenue	Reedie Dr to University Blvd	County	B???	Ken/Wheaton	1	1	2	1	Widening	No
21	Montrose Ave/Weymouth St	MD 355 to Knowles(MD 547)/Strathmore	County	B???	No Bethesda	1	1	2	1	Reconstruction	No
22	Nebel Street	Randolph Rd to Nicholson La	County	B???	No Bethesda	1	1	2	1	Widening	No
23	Reedie Drive	Georgia Ave to Viers Mill Rd	County	B???	Ken/Wheaton	1	1	2	1	Widening	No

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24	Industrial Parkway	US 29 to Tech Rd	County	I001	Fair-Belts	1	1	2	1	Widening	No
25	Gaither Road	Gude Dr to Redland Rd	County	I007	Gaith(East)	0	0	2	2	New	No
26	Tech Road	US 29 to Industrial Pkwy	County	I011	Fair-Belts	1	1	2	1	Reconstruction	No
27	Old Baltimore Road (L Bent)	Slidell Rd to Barnesville Rd(A-8)	County	A007	L. Bennett	1	1	2	1	Reconstruction	No
27	Old Baltimore Road (Clark)	Slidell Rd to MD 121 to I-270	County	A007	Clarksburg	1	1	2	1	Reconstruction	No
28	Barnesville Road	Old Baltimore Rd to MD 109	County	A007	Dick-Barn	1	1	2	1	Reconstruction	No
29	Barnesville Road (A-8)	Slidell Rd to Whites Ground Rd	County	A008	Clarksburg	1	1	2	1	Reconstruction	No
30	Bethesda Church Rd (A-11)	Ridge Rd(MD27) - Woodfield Rd(MD124)	County	A010	Damascus	0	0	1	1	New	No
31	Brink Road	Woodfield Rd(MD124) to Goshen Rd	County	A014	Goshen	1	1	2	1	Reconstruction	No
32	Goshen Road, Ph 2	MD 124 to Warfield Rd	County	A014	Gaith(East)	0	0	1	1	Reconstruction	Yes
33	Watkins Mill Road Reloc	German/Mont Vill Conn to Watkins	County	A017	Germ (East)	1	1	2	1	Widening	No
34	"New Road" (A-19)	M-83(prop) to Old Baltimore Rd	County	A019	Clarksburg	0	0	2	2	New	No
35	"New Road" (A-19)	Old Balt Rd to Father Hurley Blvd	County	A019	Germ (East)	0	0	2	2	New	No
36	"New Road" (A-22)	MD 121 to Old Baltimore Rd	County	A022	Clarksburg	0	0	2	2	New	No
37	"New Road" (A-23)	Riffle Ford Rd to Great Seneca Hwy	County	A023	Germ (West)	0	0	2	2	New	No
38	Oak Drive Extended	MD 124 to MD 27(North of Valey Park)	County	A025	Damascus	0	0	1	1	New	No
39	Piney Meetinghouse Rd	Travilah Rd to Boswell La	County	A034	Gaith(West)	1	1	2	1	Reconstruction	No
39	Meetinghouse Rd (Sh Gr W)	Meetinghouse Rd to Shady Grove Rd	County	A034	Potomac	0	0	2	2	New	No
40	Wightman Road, Reconst Sect	Mont Village Ave to Brink Rd	County	A036	Gaith(East)	1	1	2	1	Reconstruction	No
40	Wightman Road, Widen Sect	Mont Village Ave to Goshen Rd	County	A036	Gaith(East)	1	1	2	1	Widening	No
41	Twinbrook Parkway	Parklawn Dr to MD 355	County	A037	No Bethesda	1	1	2	1	Widening	No
42	Prince Philip Dr Extended	Georgia to Pr Philip Dr, NE Quadrant	County	A046	Olney	0	0	2	2	New	No
43	"New Road" (A-47)	Spartan Rd to Pr Philip Dr	County	A047	Olney	0	0	2	2	New	No
44	Briggs Chaney Road	Old Columbia Pike to US 29	County	A051	Fair-Belts	0	0	1	1	Reconstruction	No
45	Knowles Avenue	Cedar La to the west	County	A066	Ken/Wheaton	1	1	2	1	Widening	No
46	Randolph Road	Parklawn Dr to Rocking Horse Rd	County	A069	No Bethesda	2	2	3	1	Widening	No
47	Ritchie Parkway (New)	Darnestown Rd(MD 28) to Glenn Mill Rd	County	A072	Rockville	1	1	2	1	New	No

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47 Ritchie Parkway (Widening)	Seven Locks Rd to Glenn Mill Rd	County	A072	Rockville	1	1	2	1	Widening	No
48 Democracry Boulevard	Seven Locks Road to Gainsborough Rd	County	A073	Potomac	1	1	2	1	Reconstruction	No
49 "New Road" (A-74)	Waring Station Rd to Germantown Rd	County	A074	Germ (West)	0	0	2	2	New	No
50 Wisteria-?? (A-74)	Middlebrook Rd to Waring Station	County	A074	Germ (East)	1	1	2	1	Widening	No
51 Fairland East	US 29 to Brigg Chaney Rd (PG Co Line)	County	A075	Fair-Belts	0	0	1	1	Reconstruction	Yes
52 Seven Locks Road	Montrose Rd to Tuckerman Rd	County	A079	Potomac	1	1	2	1	Widening	No
53 Rockspring Drive	Old Georgetown Rd to Fernwood Rd	County	A081	No Bethesda	1	1	2	1	Widening	No
54 Fernwood Road	Democracy Blvd to Westlake Dr	County	A085	No Bethesda	1	1	1	0	Widening	No
55 Westlake Terrace	Democracy Blvd to Westlake Dr	County	A085	No Bethesda	1	1	1	0	Widening	No
56 Brigg Chaney Widen, Ph 3	Dogwood to Fairland Rd/PG Co Line	County	A086	Fair-Belts	0	0	1	1	Reconstruction	Yes
57 Montrose Road	Seven Locks Rd to I-270	County	A090	Potomac	2	2	3	1	Widening	No
58 Cherry Hill Road	US 29 to PG Co Line	County	A098	Fair-Belts	1	1	2	1	Reconstruction	No
59 East Randolph, Ph II	Old US 29 to Fairland Rd	County	A098	Fair-Belts	0	0	1	1	Widening	Yes
60 Riffle Ford Road (Germ W)	MD 118 to Gr Seneca Creek	County	A103	Germ (West)	1	1	2	1	Widening	No
60 Riffle Ford Road (Gaith W)	Darnestown Rd to Gr Seneca Creek	County	A103	Gaith(West)	1	1	2	1	Widening	No
61 Oakmont Avenue	MD 124 to Shady Grove Rd	County	A255	Gaith(East)	1	1	2	1	Widening	No
62 Slidell Road (A-258)	Comis Rd(MD 95) to MD 117	County	A258	Clarksburg	1	1	2	1	Reconstruction	No
63 Stringtown Rd Extended	MD 121 to Piedmont Rd	County	A260	Clarksburg	0	0	2	2	New	No
64 Fields Road	Sam Eig Hwy to Omega Dr	County	A261	Gaith(West)	1	2	3	1	Widening	No
65 Quince Orchard South	Dufief Mill to MD 28	County	A265	Darnestown	0	0	1	1	Reconstruction	Yes
66 "New Road" (A-278)	Midcounty Hwy to MD 124 Reloc Ext	County	A278	Gaith(East)	0	0	2	2	New	No
67 Waring Statn Road Reloc	Clopper Rd to Wisteria Dr	County	A289	Germ (East)	1	1	2	1	Widening	No
68 Lockwood Drive	US 29 to New Hampshire Ave	County	A296	Coles/WhOak	1	1	2	1	Widening	No
69 Bradley Boulevard	Seven Locks Rd to Goldsboro Rd	County	M003	Sil Spring	1	1	2	1	Reconstruction	No
70 Muddy Branch Rd (Gth East)	I-270 to W Diamond Ave (MD 117)	County	M015	Gaith(West)	2	2	3	1	Widening	No
70 Muddy Branch Rd (Gth West)	MD 28 to I-270	County	M015	Gaith(West)	2	2	3	1	Widening	No
71 Russell Avenue	Odend'hal Rd to Lakeforrest Blvd	County	M021	Gaith(East)	2	2	3	1	Widening	No
72 Goshen Road, Ph 1	Girald St to MD 124	County	M025	Gaith(East)	0	0	1	1	Reconstruction	Yes

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73	Sam Eig Highway	:Washingtonian Dev to Gr Seneca Hwy	: County :	M028	:Gaith(West) :	0	2	3	1 :	Widening	No
74	Muncaster Rd (MD115)(Rcont)	:Shady Grove Rd Ext to MD 108	: County :	M042	: Rock Creek :	1	1	2	1 :	Reconstruction	No
74	Muncaster Rd (MD115) (New)	:Airpark Rd Ext to Muncaster Rd	: County :	M042	: Rock Creek :	0	0	2	2 :	New	No
75	Muncaster Rd Reloc, Sec 1	:Airpark/Sh Grove Ext to Ex. Muncaster	: County :	M042	: Rock Creek :	0	0	1	1 :	New	Yes
75	Muncaster Rd Reloc, Sec 2	:Exist Muncaster to MD 108	: County :	M042	: Rock Creek :	0	0	1	1 :	Reconstruction	Yes
76	Shady Grove Rd Widening	:Briardale Rd to MD 115	: County :	M042	:Gaith(East) :	2	2	3	1 :	Widening	Yes
77	Brink Road	:Ridge Rd(MD 27) to MD 355	: County :	M083	: Clarksburg :	1	1	2	1 :	Reconstruction	No
78	Crystal Rock Drive	:Germantown Rd to Father Hurley Blvd	: County :	M084	:Germ (West) :	1	1	2	1 :	Widening	No
79	Middlebrook Rd (Grm East-1)	:MD 355 to Germ/Mont Village Conn	: County :	M085	:Germ (East) :	1	1	2	1 :	Widening	No
79	Middlebrook Rd (Grm East-2)	:I-270 to MD 355	: County :	M085	:Germ (East) :	2	2	3	1 :	Widening	No
79	Middlebrook Rd (Grm West)	:I-270 to Father Hurley Blvd	: County :	M085	:Germ (West) :	2	2	3	1 :	Widening	No
80	Great Seneca Hwy(Germ W)-1	:Clopper Rd (MD 117) to Middlebrook Rd	: County :	M090	:Germ (West) :	2	2	3	1 :	Widening	No
80	Great Seneca Hwy(Germ W)-2	:Gr Seneca Creek to Clopper Rd (MD 117)	: County :	M090	:Germ (West) :	0	2	3	1 :	Widening	No
80	Great Seneca Hwy(Gaith W)-1	:Gr Seneca Creek to Quince Orchard Rd	: County :	M090	:Gaith(West) :	0	2	3	1 :	Widening	No
80	Great Seneca Hwy(Gaith W)-2	:Quince Orchard Rd to Darnst'n Rd(MD28)	: County :	M090	:Gaith(West) :	2	2	3	1 :	Widening	No
81	Brigg Chaney Widen, Ph 1	:Auto Blvd to Gatehead Manor Way	: County :	M095	: Fair-Belts :	1	1	2	1 :	Reconstruction	Yes
81	Brigg Chaney Widen, Ph 2	:Gatehead Manor Way to Dogwood Dr	: County :	M095	: Fair-Belts :	0	0	1	1 :	Reconstruction	Yes
82	Rockville Facility, Sect 1	:I-270 to Montrose Rd	: County :	F010	:No Bethesda :	0	2	3	1 :	New	No
82	Rockville Facility, Sect 2	:Montrose Rd to Veirs Mill Rd	: County :	F010	:No Bethesda :	0	0	2	2 :	New	No
82	Rockville Facility, Sect 3	:Viers Mill Rd to Georgia Ave	: County :	F010	: Aspen Hill :	0	0	0	0 :	New	No
82	Rockville Facility, Sect 4	:Georgia Ave to Intercounty Connector	: County :	F010	: Aspen Hill :	0	0	1	1 :	New	No
State Roads [(Beyond 100% Funds Expended in the 5th & 6th Year of the CIP) or (Listed in the Master Plan)]											
83	Muncaster Mill Rd (MD115)	:MD 124 to Shady Grove Rd	: St-Sec :	P002	:Gaith(East) :	0	0	1	1 :	Reconstruction	No

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84	Hyattstown Road (MD 109)	I-270 to MD 355	St-Sec	A005	L. Bennett	1	1	2	1	Reconstruction	No
85	Ridge Road (MD 27) (Dam)	Bethseda Church Rd to B-5(Main St)	St-Sec	A011	Damascus	1	1	2	1	Reconstruction	No
85	Ridge Road (MD 27) (Patxt)	Howard Co Line to A-12	St-Sec	A011	Patuxent	1	1	2	1	Reconstruction	No
86	Woodfield Rd (MD 124) (Dam)	Watkins Rd to Ridge Rd(MD 27)	St-Sec	A012	Damascus	1	1	2	1	Reconstruction	No
86	Woodfield Rd (MD 124)(Gshn)	Ridge Rd(MD 27) to Warfield Rd	St-Sec	A012	Goshen	1	1	2	1	Reconstruction	No
87	Laytonville Rd (MD124/A12)	Brink Rd to Warfield Rd	St-Sec	A012	Goshen	1	1	2	1	Reconstruction	Yes
88	MD 121/Burnt Hill Road	MD 355 to Kingstead Rd	St-Sec	A027	Clarksburg	1	1	2	1	Reconstruction	No
88	MD 121	Burnt Hill Rd to Fred County Line	St-Sec	A027	Clarksburg	1	1	2	1	Reconstruction	No
89	Forest Glen Road (MD 192)	Holy Cros Hospital to Sligo Creek	St-Sec	A057	Ken/Wheaton	1	1	2	1	Widening	No
90	MD 355	Comus Rd to Old Baltimore Rd	St-Sec	A251	Clarksburg	1	1	2	1	Reconstruction	No
91	Comus Road (MD 95)	Slidell Rd to West of MD 355	St-Sec	A259	Clarksburg	1	1	2	1	Reconstruction	No
92	MD 124 Relocated Extended	New Rd to Mid County Hwy	St-Sec	A269	Gaith(East)	0	0	2	2	New	No
93	Darnstown Road-Old MD 28	Key West Ave to Shady Grove Rd	St-Sec	A280	Gaith(West)	2	2	3	1	Widening	No
94	River Road (MD 190) (Trav)	Esworthy Rd to Piney Meetinghouse Rd	St-Sec	M002	Travilah	1	1	2	1	Reconstruction	No
94	River Road (MD 190) (Pot-1)	Falls Rd to Seven Locks Rd	St-Sec	M002	Potomac	1	1	3	2	Reconstruction	No
94	River Road (MD 190) (Pot-2)	Seven Locks Rd to I495(Beltway)	St-Sec	M002	Potomac	1	2	3	1	Reconstruction	No
94	River Road (MD 190) (Pot)	Piney Branch Rd to Falls Rd	St-Sec	M002	Potomac	1	1	2	1	Reconstruction	No
94	River Rd (MD 190)(Beth-Wid)	I-270 to Goldsboro Rd	St-Sec	M002	Beth-Ch Ch	2	2	3	1	Widening	No
94	River Road (MD 190)(Beth-1)	Goldsboro Rd to Westbarb Rd	St-Sec	M002	Beth-Ch Ch	2	2	3	1	Reconstruction	No
94	River Road (MD 190)(Beth-2)	Burdette Rd to Wilson La	St-Sec	M002	Beth-Ch Ch	2	2	3	1	Reconstruction	No
95	Frederick Road (MD 355)	Old Balt Rd to Watkins Mill Rd Ext	St-Sec	M006	Germ (East)	1	2	3	1	Reconstruction	No
96	Frederick Avenue (MD 355)	Odend'hal Ave to W Diamond Ave	St-Sec	M006	Gaith(East)	2	2	3	1	Widening	No
97	Georgia Ave (MD 97), Sect 1	Elizabeth Dr to Howard County Line	St-Sec	M008	Olney	2	2	2	0	Reconstruction	No
98	Georgia Ave (MD 97), Sect 2	Intercounty Connector to MD 108	St-Sec	M008	Olney	2	2	3	1	Widening	No
99	Georgia Ave (MD 97), Sect 3	Elizabeth Dr to Howard County Line	St-Sec	M008	Olney	2	2	2	0	Reconstruction	No
100	Georgia Ave (MD 97), Sect 4	Norbeck Rd to ICC to MD 108	St-Sec	M008	Olney	2	2	3	1	Widening	No
100	Georgia Ave (MD 97), Sect 5	Layhill Rd to Glenallen Rd	St-Sec	M008	Ken/Wheaton	2	2	4	2	Widening	No
101	New Hampshire Avenue	Spencerville Rd to MD 108	St-Sec	M012	Cloverly	1	1	2	1	Reconstruction	No

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102	Veirs Mill Road	:Parklawn Dr to Randolph Rd	: St-Sec :	M013	:Ken/Wheaton :	2	2	3	1 :	Widening	: No
103	Viers Mill/Twinbrook Pkwy	:Aspen Hill to Twinbrook Pkwy	: St-Sec :	M013	:Ken/Wheaton :	2	3	4	1 :	Widening	: Yes
104	Falls Rd (MD 189) (N Beth)	:Montrose Rd to Ritchie Pkwy	: St-Sec :	M014	:No Bethesda :	1	2	3	1 :	Reconstruction	: No
104	Falls Rd (MD 189) (Rockvll)	:Montrose Rd to Ritchie Pkwy	: St-Sec :	M014	: Rockville :	1	2	3	1 :	Reconstruction	: No
104	Falls Road (MD 189) (Pot)	:Ritchie Pkwy to MacArthur Blvd	: St-Sec :	M014	: Potomac :	1	2	3	1 :	Reconstruction	: No
105	Layhill Rd (MD182) (Clov)	:Norbeck Rd to Norwood Rd	: St-Sec :	M016	: Cloverly :	1	2	3	1 :	Widening	: No
105	Layhill Road (MD182) (AspH)	:Intercounty Connector to Norbeck Rd	: St-Sec :	M016	: Aspen Hill :	1	2	3	1 :	Widening	: No
105	Layhill Rd (MD182) (Ken/W)	:Intercounty Connector to Bel Pre Rd	: St-Sec :	M016	:Ken/Wheaton :	1	2	3	1 :	Widening	: No
106	Clopper Road (MD 117)	:A-80 to Germantown Rd (MD 118)	: St-Sec :	M017	:Germ (West) :	1	1	3	2 :	Reconstruction	: No
107	Norbeck Road, Sect 1	:Bauer Rd to Baltimore Rd	: St-Sec :	M018	: Aspen Hill :	2	2	3	1 :	Widening	: No
107	Norbeck Road, Sect 2	:Layhiil Rd to Georgia Ave	: St-Sec :	M018	: Aspen Hill :	1	1	2	1 :	Widening	: No
108	MD28-MD198 Connector(Widen)	:Layhill Rd to New Hampshire Av	: St-Sec :	M018	: Cloverly :	0	0	2	2 :	Widening	: No
109	MD28-MD198 Connector (New)	:Layhill Rd to New Hampshire Ave	: St-Sec :	M018	: Cloverly :	0	0	2	2 :	New	: No
110	MD 124, Sect 1	:Warfield Rd to Fieldcrest Rd	: St-Sec :	M021	:Gaith(East) :	1	1	3	2 :	Reconstruction	: No
110	MD 124, Sect 2	:Rickenbacker Rd to Airpark Rd	: St-Sec :	M021	:Gaith(East) :	1	2	3	1 :	Widening	: No
111	MD 124, Sect 3	:Airpark Rd to Sn School Rd/MD 115	: St-Sec :	M021	:Gaith(East) :	1	2	3	1 :	Widening	: No
112	MD 124 Relocated Extended	:New Rd to Goshen Rd	: St-Sec :	M021	:Gaith(East) :	0	0	3	3 :	New	: No
112	MD 124 Relocated, Sect 1	:MD 115/MD 124 to Emory Grove Rd	: St-Sec :	M021	:Gaith(East) :	2	2	3	1 :	Widening	: No
112	MD 124 Relocated, Sect 2	:Emory Grove Rd to Midcounty Hwy	: St-Sec :	M021	:Gaith(East) :	0	2	3	1 :	Widening	: No
113	Odend'hal Road	:Russell Ave to Goshen Rd	: St-Sec :	M021	:Gaith(East) :	2	2	3	1 :	Widening	: No
114	Laytonville Rd (MD124/M21)	:Fieldcrest Rd to Warfield Rd	: St-Sec :	M021	:Gaith(East) :	1	1	2	1 :	Reconstruction	: Yes
115	Darnestown Rd (MD 28)(DBrn)	:Beallsville Rd to Martinsburg Rd	: St-Sec :	M022	: Dick-Barn :	1	1	2	1 :	Reconstruction	: No
115	Darnestown Rd (MD 28)(Pool)	:Bucklodge Rd to Beallsville Rd	: St-Sec :	M022	:Poolesville :	1	1	2	1 :	Reconstruction	: No
115	Darnestown Rd (MD 28)(LSen)	:Bucklodge Rd to Seneca Rd (MD 112)	: St-Sec :	M022	: L. Seneca :	1	1	2	1 :	Reconstruction	: No
115	Darnestown Rd (MD 28)(Darn)	:Jones La to Whites Ferry Rd	: St-Sec :	M022	: Darnestown :	1	1	2	1 :	Reconstruction	: No
115	Darnestown Rd (MD 28)(GthW)	:Quince Orchard Rd to Pol Area Line	: St-Sec :	M022	:Gaith(West) :	1	2	3	1 :	Reconstruction	: No
116	Key West Ave-MD 28 Reloc	:Shady Grove Rd to Darnestown Rd	: St-Sec :	M022	:Gaith(West) :	1	2	3	1 :	Widening	: No
117	Key West Avenue, Sect 1	:Gude Dr to Research Blvd	: St-Sec :	M022	:Gaith(West) :	1	1	3	2 :	Widening	: Yes
117	Key West Avenue, Sect 2	:I-270 to Research Blvd	: St-Sec :	M022	:Gaith(West) :	2	2	3	1 :	Reconstruction	: Yes

06-Jul-89 11:19 AM					Number of Lanes per Direction:					
Map Number Project Name	Project Limits	Type of Road: County St-Sec St-Prim St-Inter	Master Plan of Highways Number	Planning Area	Existing v v	in CIP	Ultimate # of Lanes v	Diff # of lanes: Ult.vs CIP	Type of Construction: 1-New Road 2-Reconstruction 3-Widening/ Resurfacing	Is Road in 5th or 6th Years of CIP?
118 Quince Orchard Road	:Great Seneca Hwy to Eastwards	: St-Sec :	M024	:Gaith(West) :	1	2	3	1	: Reconstruction :	No
119 Clopper Rd (MD117) (GrmW-1)	:Germantown Rd to Great Seneca Hwy	: St-Sec :	M026	:Germ (West) :	1	1	3	2	: Reconstruction :	No
119 Clopper Rd (MD117) (GrmW-2)	:Great Seneca Hwy to Waring Station Rd	: St-Sec :	M026	:Germ (West) :	1	1	3	2	: Reconstruction :	No
119 Clopper Rd (MD 117) (Gth W)	:Waring Station to Great Seneca Creek	: St-Sec :	M026	:Gaith(West) :	1	1	3	2	: Reconstruction :	No
120 West Diamond Ave, Sect 1	:Over I-270	: St-Sec :	M026	:Gaith(West) :	1	1	3	2	: Widening :	No
120 West Diamond Ave, Sect 2	:Muddy Branch Rd to I-270	: St-Sec :	M026	:Gaith(East) :	1	1	3	2	: Widening :	No
120 West Diamond Ave, Sect 3	:I-270 to Quince Orchard Rd	: St-Sec :	M026	:Gaith(West) :	1	2	3	1	: Widening :	No
121 Darnes/Germ Rd (MD 118)	:Clopper Rd to past Riffle Ford Rd	: St-Sec :	M027	:Germ (West) :	1	2	3	1	: Reconstruction :	No
121 Germantown Rd (MD 118)	:Darnestown Rd to Black Rock Rd	: St-Sec :	M027	: Darnestown :	1	1	2	1	: Reconstruction :	No
122 Father Hurley Blvd, Sect 1	:Crystal Rock Dr to Middlebrook Rd	: St-Sec :	M027	:Germ (West) :	2	2	3	1	: Widening :	No
122 Father Hurley Blvd, Sect 2	:MD 118 to Middlebrook Rd	: St-Sec :	M027	:Germ (West) :	0	0	3	3	: New :	No
123 Fathr Hurley Blvd Extended	:MD 355 to I-270	: St-Sec :	M027	:Germ (East) :	0	2	3	1	: Widening :	No
124 Ridge Rd(MD 27)/Germ Dr Ext	:Brink Rd to Frederick Rd(MD 355)	: St-Sec :	M027	:Germ (East) :	1	1	3	2	: Reconstruction :	No
125 Ridge Road (MD 27) (Dam)	:Kings Valley Rd to Bethesda Church Rd	: St-Sec :	M027	: Damascus :	1	1	3	2	: Reconstruction :	No
125 Ridge Road (MD 27) (Clark)	:MD 355 to Kings Valley Rd	: St-Sec :	M027	: Clarksburg :	1	1	3	2	: Reconstruction :	No
126 Wh Ferry Rd (MD107) (Pool)	:Hughes Rd to Darnestown Rd	: St-Sec :	M056	:Poolesville :	1	1	2	1	: Reconstruction :	No
126 Wh Ferry Rd (MD107) (Darn)	:Hughes Rd to Darnestown Rd	: St-Sec :	M056	: Darnestown :	1	1	2	1	: Reconstruction :	No
127 Clarksburg Road (MD 121)	:Old Baltimore Rd to MD 117	: St-Sec :	M057	: Clarksburg :	1	1	3	2	: Reconstruction :	No
127 MD 121	:Over I-270	: St-Sec :	M057	: Clarksburg :	1	1	3	2	: Reconstruction :	No
128 Whites Ground Rd (MD 121)	:Darnestown Rd to Clopper Rd	: St-Sec :	M057	: L. Seneca :	1	1	2	1	: Reconstruction :	No
129 Damascus Road (MD 108)	:Woodfield Rd(MD 124) to MD 650(A-13)	: St-Sec :	M060	: Patuxent :	1	1	2	1	: Reconstruction :	No
130 Doctor Bird Road (MD 182)	:Sandy Srping(MD 108) to Norwood Rd	: St-Sec :	M060	: Olney :	1	1	2	1	: Reconstruction :	No
131 Norwood Road (MD 182)	:Dr Bird Rd to Ednor Rd	: St-Sec :	M060	: Olney :	1	1	2	1	: Widening :	No
132 Laytonsville Road (MD 108)	:Damascus Rd(MD 650) to Olney Mill Rd	: St-Sec :	M060	: Olney :	1	1	2	1	: Reconstruction :	No
133 Spencerville (MD 198),Sec 1	:US 29 to PG County Line	: St-Sec :	M076	: Fair-Belts :	1	2	3	1	: Reconstruction :	No
133 Spencerville (MD 198),Sec 2	:US 29 to Old US 29	: St-Sec :	M076	: Fair-Belts :	1	1	3	2	: Reconstruction :	No
134 MD 355	:Comus Rd to MD 109	: St-Sec :	M083	: L. Bennett :	1	1	3	2	: Reconstruction :	No
135 Germ/Mont Vil Conn, Sect 1	:Comus Rd(MD 95) to MD 27	: St-Sec :	M083	: Clarksburg :	0	0	3	3	: New :	No
135 Germ/Mont Vil Conn, Sect 2	:Brink/Ridge Rd to Watkins Mill Rd Ext	: St-Sec :	M083	:Germ (East) :	0	2	3	1	: Widening :	No

Map Number	Project Name	Project Limits	Type of Road: County St-Sec St-Prim St-Inter	Master Plan of Highways Number	Planning Area	Number of Lanes per Direction: Existing v v	Ultimate v in CIP	# of Lanes v	Diff # of lanes: Ult.vs CIP	Type of Construction: 1-New Road 2-Reconstruction 3-Widening/ Resurfacing	Is Road in 5th or 6th Years of CIP?
135	Germ/Mont Vil Conn, Sect 3	parellel to MD 355:Old Balt-MD 121	St-Sec	M083	Clarksburg	0	0	2	2	New	No
136	Midcounty Highway	Watkins Mill Rd to Shady Grove Rd	St-Sec	M083	Gaith(East)	1	2	3	1	Widening	No
136	Winters Run Connection	Midcounty Hwy/ICC to Shady Grove Rd	St-Sec	M083	Gaith(East)	0	0	3	3	New	No
137	Winters Run Connect'n(Frwy)	Intercounty Connctor to Midcounty Hwy	St-Sec	M083	Rock Creek	0	0	2	2	New	No
137	Winters Run Connect'n(Ramp)	Intercounty Connctor to Midcounty Hwy	St-Sec	M083	Rock Creek	0	0	2	2	New	No
138	Colesville Rd (US 29),Sec 1	Georgia Ave to Sligo Creek Pkwy	St-Prim	M010	Sil Spring	0	0	2	2	Widening	No
138	Colesville Rd (US 29),Sec 2	Sligo Creek Pkwy to Georgia Ave	St-Prim	M010	Sil Spring	2	2	3	1	Widening	No
138	Colesville Rd (US 29),Sec 3	Sligo Creek Pkwy to Georgia Ave	St-Prim	M010	Sil Spring	2	2	4	2	Widening	No
139	US 29 HOV, Sect 1a,b,c -#1	MD 198 to Sligo Creek Pkwy--???	St-Prim	M010	Fair-Belts	2/3	3	4	1	New	Yes
139	US 29 HOV, Sect 1a,b,c -#1	MD 198 to Sligo Creek Pkwy--???	St-Prim	M010	Fair-Belts	2/3	3	4	1	New	Yes
139	US 29 HOV, Sect 1a,b,c -#2	MD 198 to Sligo Creek Pkwy--???	St-Prim	M010	Fair-Belts	2/3	3	4	1	New	Yes
139	US 29 HOV, Sect 1d	MD 198 to Howard County Line	St-Prim	M010	Patuxent	0	0	4	4	Reconstruction	Yes
139	US 29 HOV, Sect 2	Interchange @MD 198	St-Prim	M010	Fair-Belts	0	0	1	1	New	Yes
139	US 29 HOV, Sect 3	Interchange @Intercounty Connector	St-Prim	M010	Fair-Belts	0	0	1	1	New	Yes
139	US 29 HOV, Sect 4	Interchange @Univercity Blvd(MD 193)	St-Prim	M010	Kemp Mill/4C	0	0	1	1	New	Yes
139	US 29 HOV, Sect 5	Bridge at New Hampshire Ave	St-Prim	M010	Coles/WhOak	2	2	3	1	Reconstruction	Yes
140	Columbia Pike (US 29)	New Hampshire Ave to MD 198	St-Prim	CM010	Fair-Belts	2	2	3	1	Widening	No
141	Intercounty Conn (Gth E)	Sh Gr Metro Connector to Sh Grove Rd	St-Prim	F009	Gaith(East)	0	2	3	1	Widening	No
141	Intercounty Conn (Rck Ck)	Georgia Ave to Redland Rd	St-Prim	F009	Rock Creek	0	2	3	1	Widening	No
141	Intercounty Conn (Olney)	Over Georgia Ave	St-Prim	F009	Olney	0	2	3	1	Widening	No
141	Intercounty Conn (Aspn H)	Rockville Facility to Georgia Ave	St-Prim	F009	Aspen Hill	0	2	3	1	Widening	No
141	Intercounty Conn (Coles)	Rockvll Facility to Columbia Pk(US29)	St-Prim	F009	Coles/WhOak	0	2	4	2	Widening	No
141	Intercounty Conn (Frld)	US 29 to Brigg Chaney Rd	St-Prim	F009	Fair-Belts	0	2	3	1	Widening	No
142	Intercounty Connector	Sh Grove Rd/I-370 to Norbeck	St-Prim	F009	Rock Creek	0	0	2	2	New	Yes
143	I-495 Interchange @Conn Ave	New Ramp	St-Inter	M007	Beth-Ch Ch	0	0	1	1	New	Yes

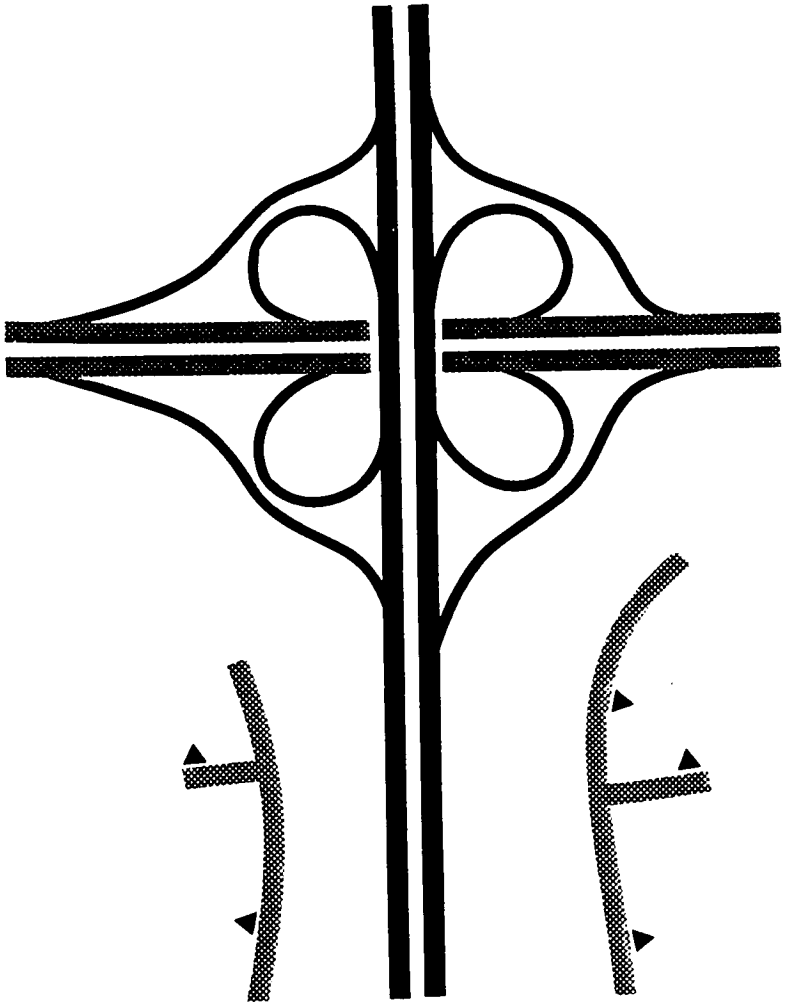
Map Number	Project Name	Project Limits	Type of Road: County / St-Sec / St-Prim / St-Inter	Master Plan of Highways Number	Planning Area	Number of Lanes per Direction: Existing	Ultimate # of Lanes	Diff # of lanes: Ult.vs CIP	Type of Construction: 1-New Road 2-Reconstruction 3-Widening/ Resurfacing	Is Road in 5th or 6th Years of CIP?
06-Jul-89 11:19 AM										
143	I-495 Interchange @Conn Ave	widen Connecticut Ave	St-Inter	M007	Beth-Ch Ch	3	4	1	Widening	Yes
144	I-270 (National Pk)(Germ)-1	Old Baltimore Rd to MD 118	St-Inter	F001	Germ (West)	2	4	1	Widening	No
144	I-270 (National Pk)(Germ)-2	MD 118 to Middlebrook Rd	St-Inter	F001	Germ (West)	3	4	1	Widening	No
144	I-270 (National Pk) (Clrk)	Old Baltimore Rd to Clarksburg Rd	St-Inter	F001	Clarksburg	2	4	1	Widening	No
145	West Spur I-270 (Reconst)	I-495 to I-270 Split	St-Inter	F001a	No Bethesda	2	3	1	Reconstruction	Yes
145	West Spur I-270 (Widen)	I-495 to I-270 Split	St-Inter	F001a	No Bethesda	2	3	1	Widening	Yes
146	East Spur I-270 (Widen)	I-495 to I-270 Split	St-Inter	F001	No Bethesda	2	3	1	Widening	Yes
146	East Spur I-270 (Reconst)	I-495 to I-270 Split	St-Inter	F001	No Bethesda	2	3	1	Reconstruction	Yes
147	I-370	Redland Rd to Shady Grove Rd	St-Inter	F009	Gaith(East)	0	3	1	Widening	No

NOTE: Key to Type of Road:
County=County Road
St-Sec=State, Secondary
St-Prim=State, Primary
St-Inter=State, Interstate

Appendix 2

HOV Treatments by Road Links

FREEWAYS



- LIMITED ACCESS
- GRADE SEPARATED INTERCHANGES
- NO LOCAL ACCESS

Key:

Freeway

Major Highway or Arterial

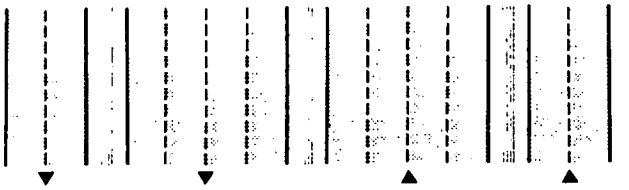
Local Road

Access to Property

Fig. 8

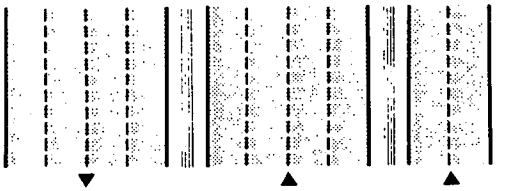
MASTER PLAN (LOV) - FREEWAYS

2 / 4 / 4 / 2



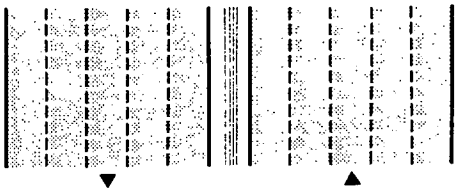
I-270 from Md 117 to Spurs

4 / 4 / 2



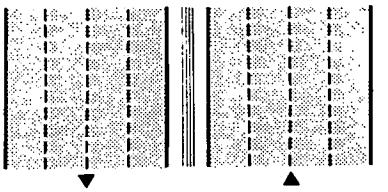
I-270 from Md 124 to Md 117

5 / 5



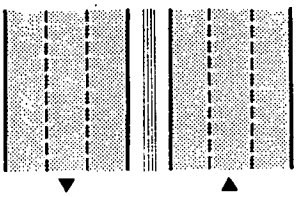
I-495 from River Road to West Spurs

4 / 4



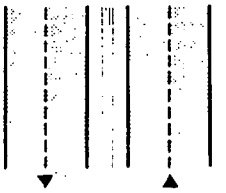
I-270 from Md 121 to Md 124
ICC Rockville Facility to I-95
I-95 Outside County
I-495 I-95 to Md 355/East Spurs
I-495 Potomac River to River Road

3 / 3



I-270 from Frederick County line to Md 121
I-370 I-270 to ICC
ICC I-370 to Rockville Facility
I-495 West Spur to East Spur/Md 355
I-270 West Spur
I-270 East Spur

2 / 2



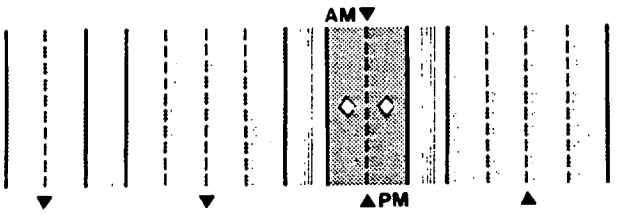
CABIN JOHN PKWY I-495 to G.W.Pkwy

Fig. 9

HOV - FREEWAYS

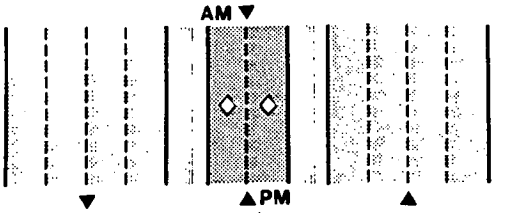
EXCLUSIVELY REVERSIBLE - PEAK DIRECTION ONLY

4 / 2R / 4 / 2



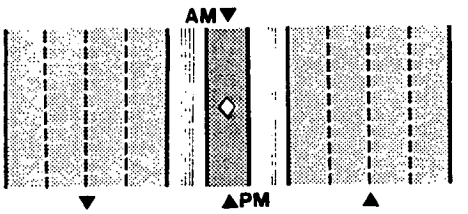
I-270 from Md 124 to Md 117

4 / 2R / 4



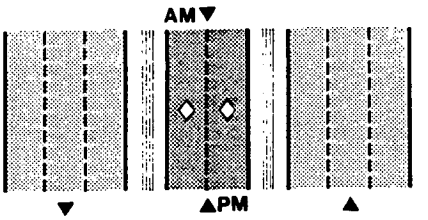
I-270 from Md 121 to Md 124

4 / 1R / 4



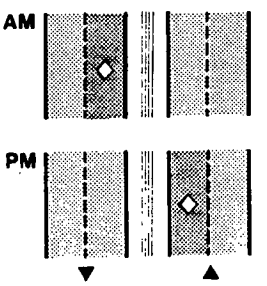
I-95 Outside County

3 / 2R / 3



I-270 Frederick County line to Md 121

1 + 1 / 2



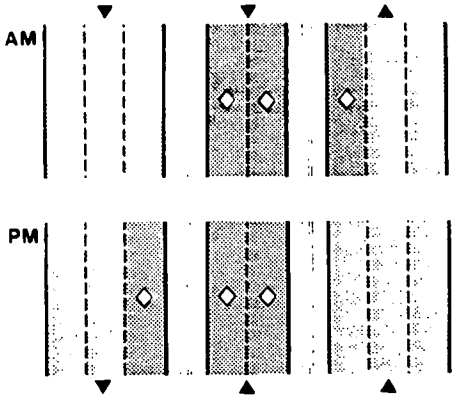
CABIN JOHN PKWY I-495 to G.W.Parkway

Fig. 10

HOV - FREEWAYS

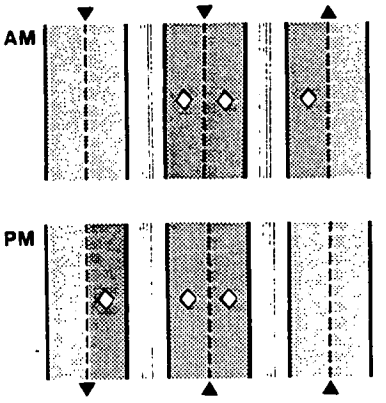
MOSTLY REVERSIBLE - PREDOMINANT PEAK DIRECTION BUT ALSO OPPOSING DIRECTION

3 / 2R / 2 + 1



ICC from Rockville Facility to I-95

2 / 2R / 1 + 1



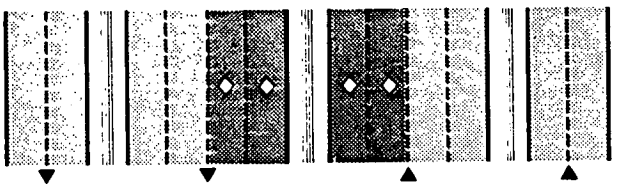
ICC from I-370 to Rockville Facility

Fig. 11

HOV - FREEWAYS

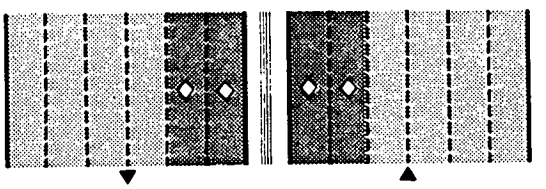
BI DIRECTIONAL - PEAK VOLUMNS IN BOTH DIRECTIONS

2 / 2 + 2 / 2 + 2 / 2



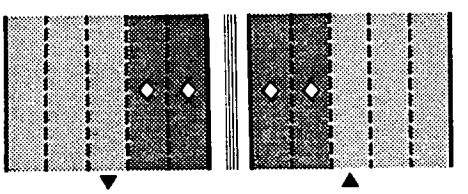
I-270 Md 117 to Spurs

2 + 4 / 4 + 2



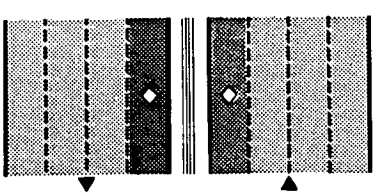
I-495 I-95 to US 29
River Rd. to West Spur

2 + 3 / 3 + 2



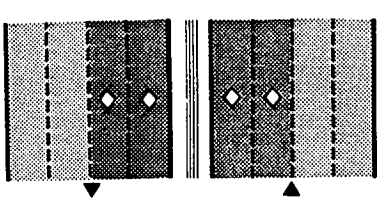
I-495 US 29 to East Spur / Rt.355
Potomac River to River Rd.

1 + 3 / 3 + 1



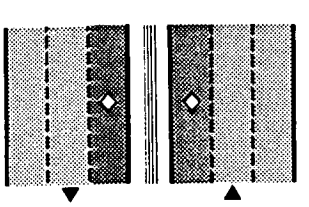
I-495 West Spur to East Spur

2 + 2 / 2 + 2



I-270 West Spur

1 + 2 / 2 + 1

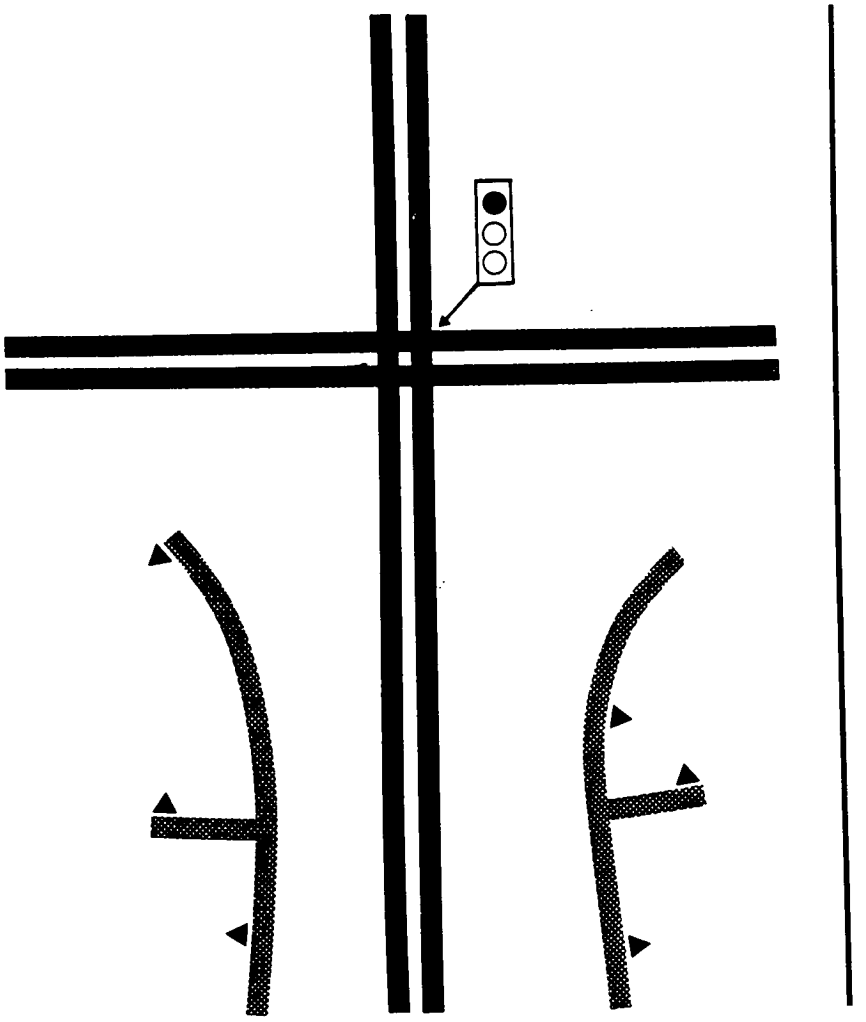


I-270 East Spur

I-370 I-270 to ICC

Fig. 12

MAJOR HIGHWAYS



- LIMITED ACCESS
- AT GRADE INTERSECTIONS

Key:

Major Highway

Arterial

Local Road

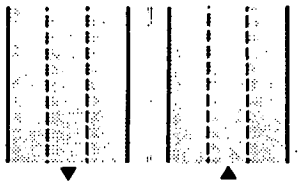
Access to Property

Traffic Light

Fig. 13

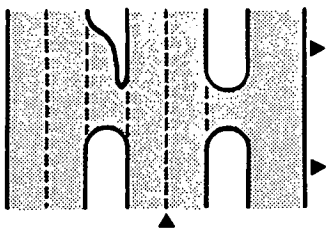
MASTER PLAN (LOV) - MAJOR HIGHWAYS

3 / 3



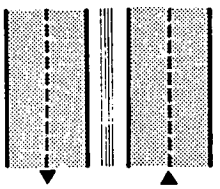
Md 27	South of Damascus to I-270
MID CO. HWY	Md 27 to ICC
GREAT SENECA HWY	I-270 to Richie Pkwy.
SHADY GROVE RD	Great Seneca Hwy to Mid-Co.
GUDE DR.	Shady Grove Rd. to Md 355
US 29	County line to Md 650

2 / 2 + Service



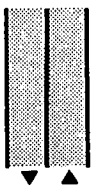
Md 28	Md 355 to Md 97

2 / 2



Md 27	County line to South of Damascus
GUDE DR.	Md 355 to Md 28
ROCKVILLE FACILITY	Veirs Mill Rd to Md 355
	Md 355 to East of I-270

1 / 1



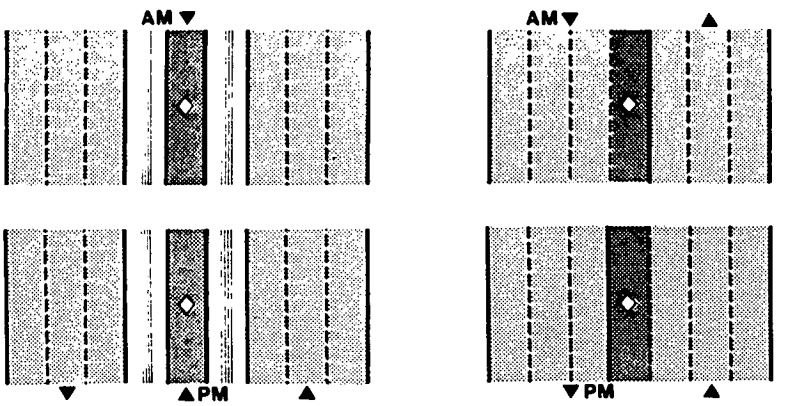
ROCKVILLE FACILITY	ICC to Md 97

Fig. 14

HOV - MAJOR HIGHWAYS

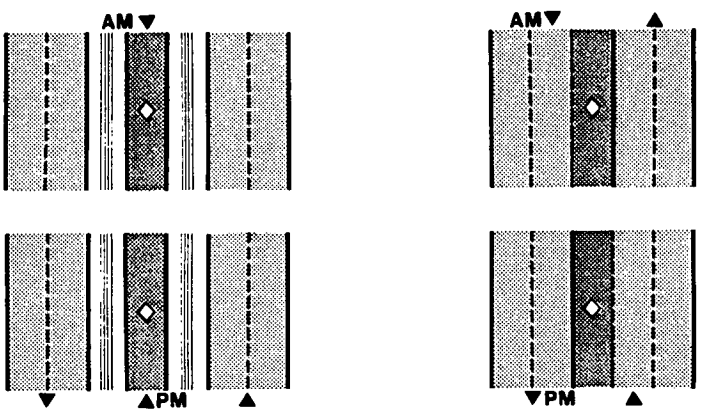
EXCLUSIVELY REVERSIBLE - PEAK DIRECTION ONLY

3 / 1R / 3



US 29 County line to Md 650 (N.H.Ave.)

2 / 1R / 2



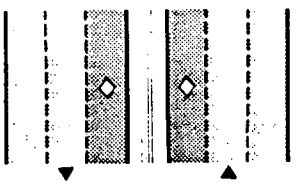
Md 27 County line to I-270
MID CO. HWY Md 27 to ICC
GREAT SENECA HWY I-270 to Richie Pkwy
GUDE DR. Shady Grove to Md 355

Fig. 15

HOV - MAJOR HIGHWAYS

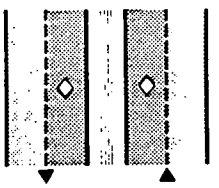
BI DIRECTIONAL

1 + 2 / 2 + 1



SHADY GROVE RD	Great Seneca Hwy to Mid-Co.
Md 28	Md 355 to Md 97

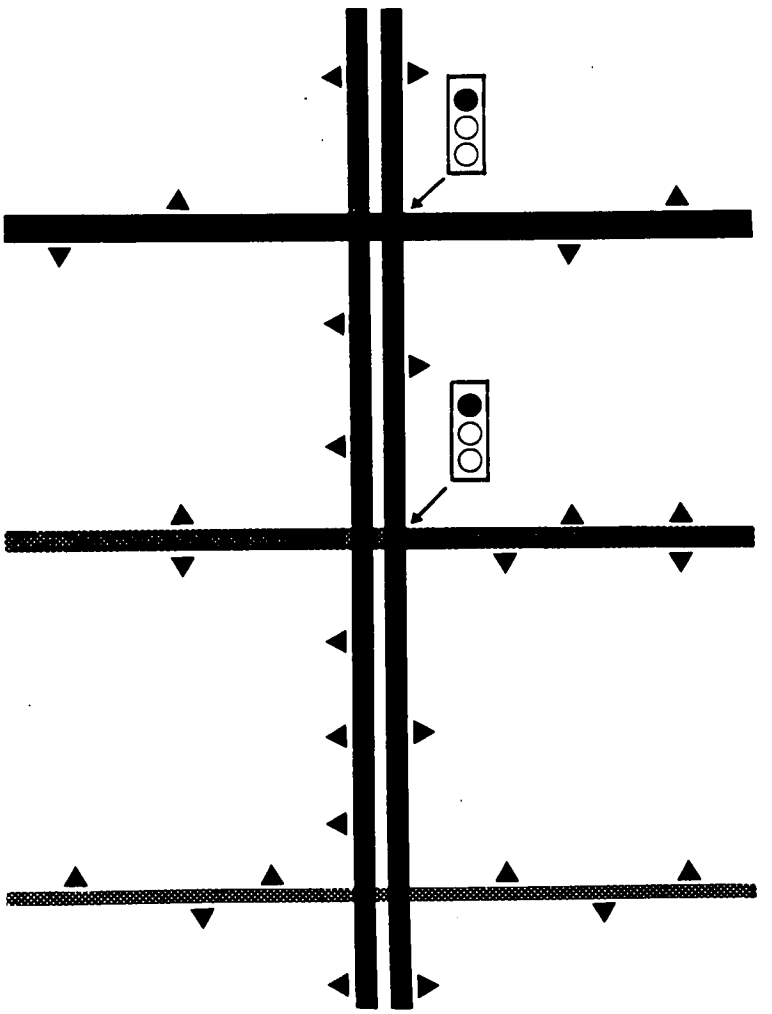
1 + 1 / 1 + 1



GUDE DR.	Md 355 to Md 28

Fig. 16

ARTERIALS



- LOCAL ACCESS
- FREQUENT AT GRADE INTERSECTIONS

key:

Arterials

Primary Residential Street

Secondary Residential Street

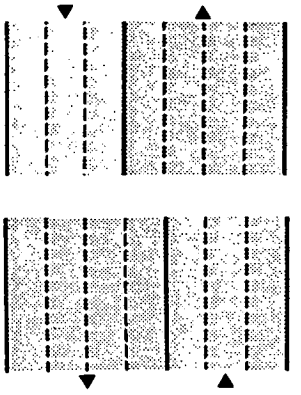
Property Access

Traffic Light

Fig. 17

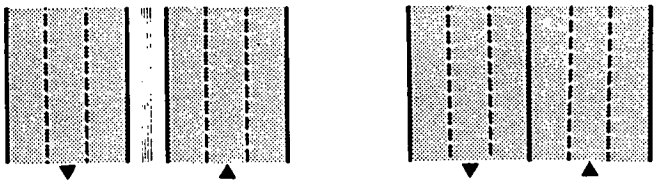
MASTER PLAN (LOV) - ARTERIALS

3 / 1 / 3



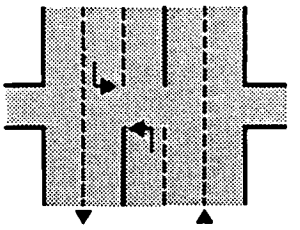
US 29 Md 650 to Silver Spring

3 / 3



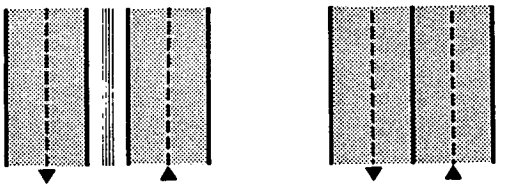
CONNECTICUT AVE. Md 97 to DC line
OLD GEORGETOWN RD Md 355 to NIH
RIVER RD
Md 97

2 / 1 / 2



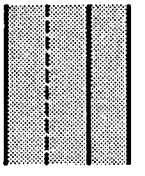
OLD GEORGETOWN RD NIH to Wisconsin Ave.

2 / 2



RICHIE PKWY Great Seneca Hwy to Md 28

2 / 1



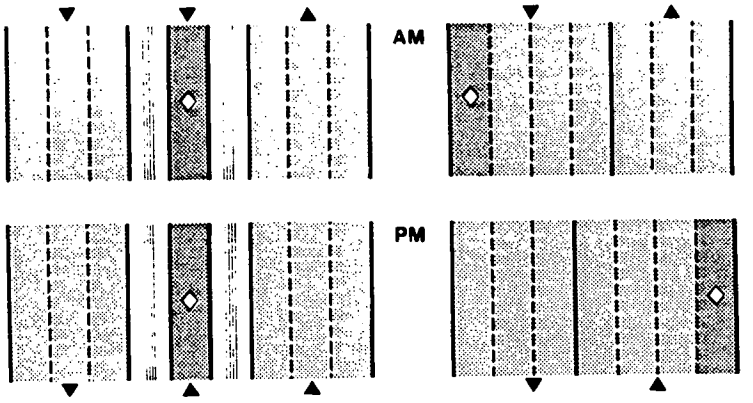
RIVER RD

Fig. 18

HOV - ARTERIALS

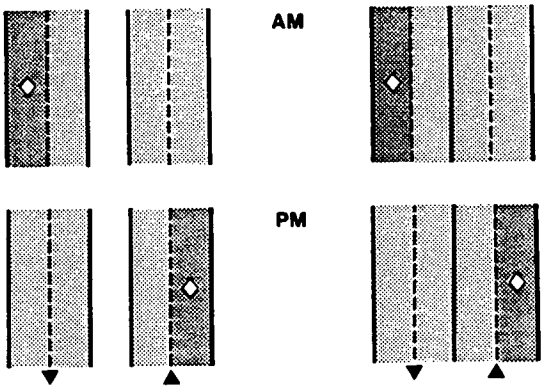
EXCLUSIVELY REVERSIBLE

3 / 1R / 3



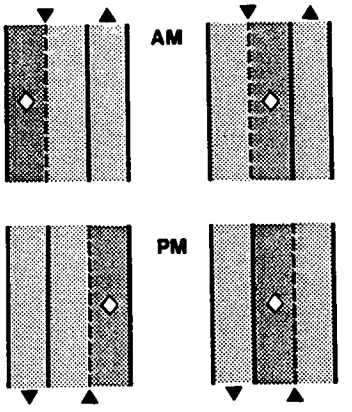
US 29 County line to Md 650 (N.H.Ave.)

1 + 1 / 2



RIVER RD

1 + 1 / 1



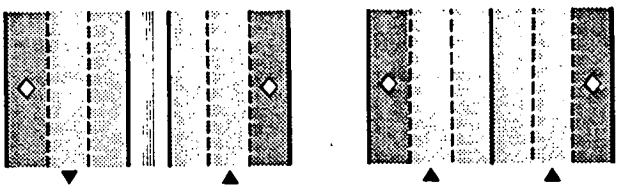
RIVER RD

Fig. 19

HOV - ARTERIALS

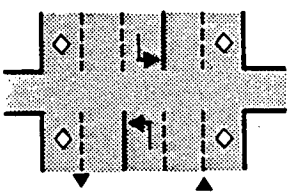
BI DIRECTIONAL

1 + 2 / 2 + 1



CONNECTICUT AVE. Md 97 to DC line
OLD GEORGETOWN RD Md 355 to NIH

1 + 1 / 1 / 1 + 1

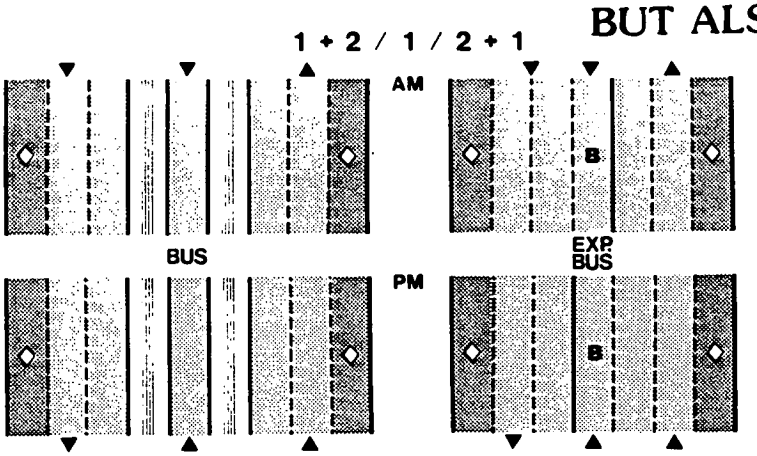


OLD GEORGETOWN RD NIH to Wisconsin Ave.

Fig. 20

HOV - ARTERIALS

MOSTLY REVERSIBLE - PREDOMINANT PEAK DIRECTION BUT ALSO OPPOSING DIRECTION



US 29 Md 650 to Silver Spring

Fig. 21

Appendix 3

Comprehensive Growth Policy Implications of Smart Car/Highway Technology

COMPREHENSIVE GROWTH POLICY IMPLICATIONS OF SMART CAR/HIGHWAY TECHNOLOGY

Prepared for the MNCPPC Comprehensive Growth Policy Study
by Richard H. Pratt, Consultant, Inc.
under Subcontract to COMSIS
April 28, 1989

This paper gives background information on Smart Car/Highway technology and the possible effects this technology may have on transportation in the Montgomery County of the future. The paper is specifically intended to aid in assessing the Comprehensive Growth Policy implications of Smart Car/Highway technology.

All information in this paper is based on or extrapolated from telephone interviews by the author with Dr. Edward Wiener, Office of the Secretary, USDOT; Mr. Howard Ross, consultant to the PATH project in California; and Dr. Walter Zimdahl of Volkswagen in Germany. Mr. Dieter Klinger of COMSIS placed the first of two calls made to Dr. Zimdahl, and some of the information obtained from Dr. Zimdahl is from that call.

The next three sections of the memorandum serve to record the information obtained directly from these interviews. The final section presents a synthesis of this information and the conclusions reached.

Dr. Edward Wiener, DOT-OST

Smart Car/Highway technology breaks down into two functional areas. One is the area of driver information systems, with in-vehicle displays featuring such aids as maps, real time information on driving conditions, and alternate route suggestions. The other is the area of actual vehicle and highway automation.

Large scale implementation of driver information systems is expected to come sooner than vehicle and highway automation. The long term goal is a fully automated highway system. However, even in the future, automated vehicle operation will be fully grade separated.

In the 1989 appropriation act, Congress, concerned that the U.S. was lagging behind Europe and Japan, ordered a study of vehicle and highway automation to determine what promise it has and what actions are appropriate and needed to ensure that the U.S. does not miss out on the technology. DOT-OST is working with the National Highway Traffic Safety Association (NHTSA) and the Federal Highway Administration (FHWA) on this study.

A demonstration to start shortly on a 12-mile section of the San Diego Freeway, between the vicinity of Anaheim and the Los Angeles Harbor, will

test video displays showing the highway network and traffic conditions including delays and accidents. Alternate route suggestions will not be provided, but drivers can pick out their own alternate routes on the video display map. GM is donating 25 cars for this demonstration. These cars will be outfitted with video screens and ETAC units.

Other demonstrations progressing in London, Berlin and Japan do include provision of alternate route information. In the Tokyo AMTEX project, the information includes advice on alternate routes, plus where parking is available and tourist information. Toyota presently offers cars equipped with maps on disc.

As driver information systems become further developed, available in vehicles and on home TV, driver behavior could change. A driver could decide, for example, to delay a trip or pick a new path even before leaving home. Such information systems could encompass real time ridesharing information and information on transit options. By such means, driver information systems may provide added transportation capacity through trip shifting to lesser utilized facilities, less congested travel times, and ridesharing options. The effective capacity gain might be on the order of 10%.

With respect to automated highway capacity, GM did a study in 1981 that estimated a 10% capacity gain could be achieved through highway automation. No one in the U.S. is looking at HOV applications per se (however, see interview with Mr. Ross). Europe is thinking a bit about HOV priority.

Mr. Howard Ross, PATH Consultant

The PATH project is a multi-million dollar California R&D effort being done under directive from Caltrans and the University of California. The project will be experimenting this year with decreasing vehicle intervals through use of radar. Michigan DOT is similarly involved with vehicle automation through their Intelligent Vehicle Highway System project.

Mr. Ross describes himself as a technology optimist. Some say there won't be much in the way of highway automation for 30-40 years. Others say 10-20 years. Mr. Ross believes there will be large scale demonstrations in the 1990's (involving HOV lanes; see below). He expects technological success, with deployment occurring after 2000.

Liability, fail safe operation, and also privacy are acknowledged as institutional issues of major importance affecting automated vehicle and highway implementation. With respect to Tort liability, the automobile industry says it cannot be responsible for malfunction. The solution may be a new means of insuring against failure, such as self insurance by the State.

Fail safe operation is a railroad based concept. Mr. Ross feels the institutional requirement for fail safe operation defeated Personalized Rapid Transit (PRT) in the 1970's. He equates such requirements to the red flag law of the late 1800's in England, which required a flagman walking in advance of highway steamcars, and delayed automobile introduction for 30 years.

Mr. Ross believes that automated highways must achieve an accident rate 10 to 20% of today's rate, and that with such performance, the immense potential saving to society will lead to social innovations providing relief from constraints such as fail safe requirements. He sees the safety requirements evolving from highway rather than railroad practice, much as air travel safety has evolved separately, and expects them to be performance based.

Operation in snow and ice will be facilitated by having the vehicle act as a sensor through use of frequent small test brake applications. The behavior of the test vehicle will be adjusted accordingly.

Privacy is an issue because all automated vehicle movements will be known. However, society already accepts the telephone companies having such knowledge about telephone communication.

With respect to retrofitting existing vehicles, another factor affecting speed of implementation, the capability should exist, probably in the form of retrofit kits. However, experience has indicated that retrofitted vehicles have inferior performance. Mr. Ross's hunch is that vehicle automation will be a gradual enough process that it can be introduced in the course of normal vehicle turnover.

The initial applications of automated highway technology will be to HOV facilities, i.e., HOV lanes separated from mixed traffic lanes by at least the minimum separation provided on L.A.'s El Monte HOV facility; a 4-foot buffer with rubber stanchions. Caltrans/PATH is making a $500,000 case study of application to HOV lanes.

The first application is expected to be on I-15 north from San Diego, which has a 2-lane reversible roadway, with its 12-foot lanes separated from the main highway on both sides by 10-foot shoulders plus Jersey barriers. (The total reversible roadway pavement width is 44-feet.) This application will be in the 1990's. Larger scale demonstrations are expected for 2000.

Mr. Ross finds the idea of automating a lane immediately adjacent to mixed traffic lanes "appalling." The "Commuter Lane" or "Diamond Lane" type of HOV reserved lane falls in this category. Automated and manual operation cannot be mixed. Separation will have to be carefully thought out. Having automated and manual lanes adjacent will not work.

Once automation of HOV facilities is mastered, the next step will be freeways. Surface arterials will be harder to deal with, but will have to be addressed ultimately.

The capacity gain with vehicle/highway automation will be 10 to 20%. In the case of HOV lanes, the California experience is that with a 4-foot buffer the driver tends to feel bottled up and drives at lower speeds and with greater spacing than normal, producing a 1,700 vehicles per hour capacity. The automation objective will be to attain the normal upper limit freeway lane capacity of 2,000 vehicles per hour (an 18% increase). Information transfer is also expected to help HOV usage by letting drivers know where and when to pick up passengers.

Mr. Ross would offer the following advice to MNCPPC: Build everything [highways] that you can but at the same time be aware of the differences in transportation technology that may influence post-2000 conditions. He gives the example of Los Angeles, where study shows that double decking the freeways would cost $30 billion and take 15 years, making Caltrans inclined to think that approaches like highway automation hold more promise.

Dr. Walter Zimdahl, Volkswagen

Germany's Prometheus automated highway project has progressed to the point of having test vehicles and simulations. The simulations are for [grade separated highways] only. The estimated date for introduction of operations on a demonstration basis using special roadways is 2000, with prototypes coming earlier.

The importance of liability questions is understood and reliability is being taken to be of paramount concern. At this stage of research institutional issues such as fail safe requirements have not been addressed, and the focus is simply on producing a high level of reliability. The reliability issue will require much R&D.

If the concept of highway automation is accepted, the transition from demonstration projects to full scale operation could be accomplished in 10 to 20 years. The capacity increase attainable could be tremendous; a factor of 2 or 3.

This 2 or 3 times capacity increase pertains only to special roadways, such as might be constructed for long distance travel. Full grade separation would be required. Other assumptions are suspicious. Capacity increases accruing from highway automation of the type that would apply to grade separated urban area highway facilities may be on the order of 10 to 20%.

[Reasons why the major capacity increases would not apply to urban roadways were not discussed in the interview, but presumably it is impractical to assemble and disassemble the platoons of vehicles envisioned in the Prometheus project at the number of locations imposed by urban interchange spacing. Vehicle platoons may well need to be comprised of vehicles starting at the same place and going to the same place.]

Dr. Zimdahl is involved with the U.S. DOT Mobility 2000 project. Contacts are Michael Finkelstein of NHTSA and Lyle Saxon of FHWA.

Extrapolations and Conclusions

These extrapolations and conclusions are not based on any original research, but simply on the three interviews recorded above. However, the interpretations, extrapolations and conclusions are those of the author, as are any errors in reporting the results of the interviews.

Possibilities of doubling or tripling highway capacity by means of automation do not apply to the urbanized conditions of Montgomery County.

The Prometheus project estimate that highway capacity may be increased by 2 or 3 times with automation pertains only to special roadways, such as might be constructed for long distance travel. Capacity increases for grade separated urban type highway facilities may be on the order of 10 to 20%.

If automated long distance highways do come about, their terminals may prove to be suburban traffic generators akin to airports. Imagine the termination in the suburbs of a facility carrying 5,000 vehicles per lane per hour. Each such *lane* would require 2 1/2 automated urban freeway lanes, or three conventional freeway lanes, or five to eight arterial lanes, to bring traffic to it or carry traffic away.

Full scale freeway and toll road automation, if it comes about, will not be widespread for at least 40 years.

The expectations of the researchers interviewed appear relatively consistent. Here is a synthesis and extrapolation of their progress expectations:

Technology -->	Advanced Driver Information	Automation of Separate	Automation of Grade Separated
Time Period	Systems	HOV Facilities	Highways
1990-1995	Limited Demos	Experiments	Experiments
1995-2000	Major Demos	Limited Demos	Prototypes
2000-2010	Application	Major Demos	Demo Projects
2010-2020	Full Scale	Application	Limited Application
2020-2030	Operations	Full Scale	Expanded Application
2030 +		Operations	Full Scale Operations

A corollary conclusion is that benefits of full scale highway automation will not be a significant factor in either congestion reduction or in the amount of infrastructure required for a given level of development before 2030.

Most applications in the next half century will be limited to grade separated HOV facilities and highways.

It seems reasonable to conclude that surface streets will not be amenable to automation in the foreseeable future. Surface street automation applications are likely to be limited to certain safety override functions and perhaps driver assistance in conforming with traffic signal progression.

The first Smart Car benefits will flow from advanced driver information systems, which by 2000 may begin to afford capacity gains ultimately expected to reach 10%.

Potential technology induced driver behavior changes include trip shifting to lesser utilized facilities, less congested travel times, and ridesharing options enhanced by real time carpool matching information.

The estimated capacity gain on the order of 10% should be used with some caution. There is potential for partial double counting with whatever estimates are being used for congestion reduction associated with Travel Demand Management (TDM). Also, the potential for shifting traffic to lesser utilized facilities is more limited in Montgomery County than in areas with well developed multilane arterial grids with mile or half mile spacings.

Among the ridesharing options that may be enhanced by advanced driver information systems is Instant Carpooling

Instant Carpooling is the phenomenon observed in Springfield, Virginia and the San Francisco East Bay, whereby prospective carpool passengers gather at informally designated areas to be picked up by drivers wishing to increase their occupancy enough to gain access to time saving HOV facilities. Advanced driver information systems may provide the electronic equivalent of the instant carpooling gathering places, and allow instant carpooling to work with lower commuter densities. The user benefits that promote instant carpooling would still have to pertain, namely, major time savings for HOV travel.

The first automated highway benefits will probably accrue in HOV lane operation.

Large scale demonstrations of automated HOV facilities may be in place by 2000 to 2010, with more limited demonstrations coming earlier. When the technology is fully developed, such facilities may offer capacity some 15 to 20% higher than non-automated HOV facilities, in addition to improved traffic flow and attractiveness.

Automated HOV lane operation is an aspect of Smart Car/Highway technology of special potential interest to Montgomery County.

The alternative transportation plan tests MNCPPC has undertaken for Comprehensive Growth Policy evaluation have shown that conventional HOV

lanes have cost effectiveness advantages over widespread use of more capital intensive transportation modes such as LRT. One disadvantage of a conventional HOV solution is that it is not as technologically sexy as LRT, making it harder to garner public and political support. Now, the promise of HOV facility automation offers both the potential capacity and traffic flow benefits and a technologically innovative solution.

Automation benefits will initially accrue only to those HOV facilities that are both grade separated and buffered from mixed flow traffic.

Automation of anything but fully grade separated facilities is for the distant future, if ever. Moreover, automated and manual operation apparently cannot be mixed. This rules out arterial HOV lanes. It also means that automation of the "Commuter Lane" or "Diamond Lane" type of unseparated HOV reserved lane could only take place as part of automating the entire facility. Having automated and manual lanes immediately adjacent will not work; there must be lateral separation.

Of HOV lanes in the Washington area today, only the Shirley Highway HOV lanes qualify as having both grade and lateral separation, along with their planned extension. The implication for Montgomery County strategic planning is that full flexibility to accomplish HOV lane automation, either initially or as a later conversion, requires obtaining right-of-way and designing parallel facilities such that grade separation and lateral separation can be achieved.

Unseparated HOV lanes on freeways could be automated when the entire freeway is automated, perhaps in the 3rd or 4th decade of the 21st century. HOV lanes on arterials are unlikely to be automated within any foreseeable planning horizon.

When Automation comes to mixed traffic facilities, they, too, must be grade separated. Montgomery County may wish to consider emphasizing new alignment HOV and mixed traffic facilities that can be separated, in contrast to relying primarily on widening of existing arterial highways.

Montgomery County has traditionally relied more on widening existing arterial highways than on introducing new facilities. At such time as highway automation arrives, arterial highways will not be candidates. The candidates will be, first, grade and laterally separated HOV facilities, and then grade separated, access controlled highways in general.

That does not mean that only HOV facilities and freeways meeting Interstate Highway standards will be candidates. Parkways and junior expressways should also qualify, so long as they meet the criteria of grade separation and access control, and, one may presume, have reasonably generous interchange spacing. If Montgomery County wants to position itself for possible highway automation, it should revisit its highway plan and look for and preserve opportunities and rights-of-way for separated facilities.

Appendix 4

Calibration of a Mode Choice Model

APPENDIX 4

Calibration of a Mode Choice Model to Support Development of the Comprehensive Growth Plan for Montgomery County, Maryland

Several key issues in development of the Comprehensive Growth Plan deal with the likely choice of travel mode under different sets of policies and with different kinds of improvements to the highway and transit systems. To deal with these issues, the analysis has included the calibration and testing of a new method for predicting mode choice for commuter trips within the county.

Background

The method is similar to the approach used in nearly all larger urban areas of the country. It uses the "logit" model as a basis to compute the share of work trips between residential areas and employment locations that will use each available travel mode. The share for each mode is determined from the attractiveness, or "utility," of that mode compared to all of the other modes. For example, the share of commuters using transit for a particular trip to work -- Gaithersburg to Bethesda, for example -- is:

$$\text{Transit Share} = \frac{\text{Transit utility}}{\text{Transit utility} + \text{Drive-alone utility} + \text{Rideshare utility}}$$

If transit has a utility of 1.0 while Drive-alone and Rideshare have utilities of 3.0 and 2.0 respectively, then the transit share would be:

$$\text{Transit Share} = \frac{1.0}{1.0 + 3.0 + 2.0} = \frac{1.0}{6.0} = 0.166$$

This result indicates that nearly 17 percent of all commuter trips from Gaithersburg to Bethesda would use transit. A similar calculation for this example would yield a 50 percent share for Drive-alone and a 33 percent share for Rideshare. Development of a forecast for the entire county requires an analogous calculation for all trips from each residential area to each employment area.

Calibration of this mode choice model involves the identification of the characteristics of the travel modes and of commuters that determine the utility of each mode. Usually, these characteristics include the travel time and cost for each mode, the income or auto-ownership level of the commuter's household, and possibly the density or land-use type of the workplace. Calibration requires a set of data that describe the alternative modes available to a number of commuters, the characteristics of both the modes and the commuters, and the choices actually made by the commuters. A computer

program designed for calibration of mode choice models then examines the options available and the choices made to determine the relative importance of the various influences on mode choice. The calibration program assigns a "weight" to each of the important characteristics, and the weight then determines the contribution of each characteristics to forecasts of future mode choice patterns. For example, the calibration results typically indicate that commuters view walking, waiting, and transferring time on transit as more inconvenient than time spent in a transit vehicle. Therefore, the model will forecast more of a reaction to transit improvements that increase service frequencies and reduce transferring, than those which increase transit speeds.

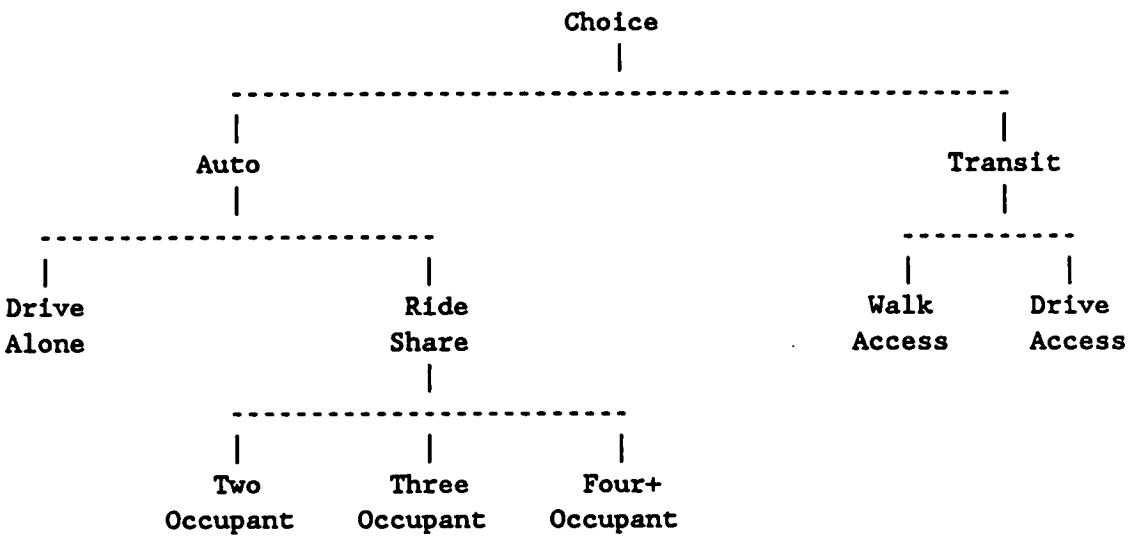
A Mode Choice Model for Commuter Travel in Montgomery County

The model developed for Montgomery County considers six alternative travel modes. The primary alternatives are auto (with four occupancy levels) and transit (with walk- and drive-access). The detail with which the model represents travel modes reflects the wide variety of alternative facilities and policies considered for the Comprehensive Growth Plan. The auto-occupancy alternatives permit calculation of shifts in average auto occupancy caused by changes auto operating costs and parking prices, as well as the possible construction of reserved HOV-lanes for vehicle with particular occupancy levels. The detailed representation of transit-access permits analysis of alternative strategies to increase transit ridership that involve more intensive transit coverage of neighborhoods and/or more emphasis on park/ride lots served by express transit lines.

Calibration of the model used data collected by the Metropolitan Washington Council of Governments (MWCOG) in 1987 and 1988. The data are the results of a large, regionwide telephone survey of households that obtained descriptions of the households themselves, the trips made by household members, and the travel modes they used. The calibration used only those surveys from residents of Montgomery County, a total of 2,100 trips to work.

Figure 1 outlines the structure of the resulting model. This structure is unique in that it uses relatively advanced methods to create subgroups of similar alternatives. This approach recognizes the similarities between subsets of the alternatives and structures the model in a way that provides for closer interaction among subgroups than between subgroups. The structure indicates that the primary mode choice is between auto and transit. Within the auto alternative, a secondary choice exists between driving alone and ridesharing, while a third choice of occupancy level exists for carpoolers. The secondary choice within the transit alternative is between the two access modes. The implication of this structure is that an improvement in a mode will draw relatively more commuters from other modes in the same subgroup, and relatively fewer from modes in other subgroups. This property gives a more realistic forecast of the effect of various improvements, particularly for improvements that affect only one mode in a subgroup. For example, an HOV

Figure 1. Structure of the Mode Choice Model for Commuters in Montgomery County



lane for 4+person carpools will attract relatively more commuters from lower-occupant carpools than from transit.

The model includes sensitivity to a wide variety of characteristics of modes and commuters. The utility of the ridesharing options includes:

- o shared-ride in-vehicle time (including time savings on any HOV lane)
- o shared-ride cost, both operating and parking, shared among occupants
- o auto-ownership of the commuter's household

The utility of the transit options includes:

- o transit in-vehicle time
- o transit walk time
- o transit wait time
- o transit fare
- o an index of "transit serviceability" at the residence location
- o a similar index "transit serviceability" at the workplace location
- o whether the workplace is in downtown Washington
- o auto-ownership of the commuter's household

Finally, the utility of the drive-alone option includes:

- o drive-alone in-vehicle time
- o drive-alone cost, both operating and parking

A significant and unique feature of the utility of transit is the inclusion of the serviceability indices at both the residence and workplace. These indices represent a variety of characteristics of local areas that are significant influences on transit ridership, but are so difficult to measure that they are nearly always omitted from mode choice models. These attributes include the presence or absence of sidewalk and bus shelters, the degree to which development is single- or multi-use, and the presence of any restrictions on auto use. Calibration of the model demonstrated the important role of these characteristics at both ends of the commute trip. The inclusion of these indices in the model provides a much broader array of sensitivities to alternative strategies to increase transit ridership in the county.

The final step in development of the mode choice model was validation of its predictions against observed travel patterns in the county. The validation tests examined the estimated transit share and auto occupancy for trips to and from the various planning areas in the county. The tests compared the model's estimates against the actual behavior observed in the MWCOG survey data. In all areas of the county, the model estimated both transit shares and auto occupancies with a high level of accuracy. These results suggest that the model includes correct sensitivities to the important characteristics of the alternative modes and therefore provides a reliable method for estimating future conditions.

Appendix 5

Bus/HOV Serviceable Site Planning

Bus/HOV Site Serviceable Planning

7/18/89

Summary Outline:

- Typical suburban development results in long, unsheltered walks to bus stops, and circuitous bus routes that delay passengers and contribute to high operating costs.

- Bus/HOV serviceable site planning would produce shorter, sheltered walks to bus stops, faster bus trips, and lower bus operating costs

- Bus/HOV serviceable site planning will require better advance planning for bus service, including possibly the inclusion of bus route planning in master plans.

- Efforts should be made to develop ways retrofit existing development so that it is more transit serviceable.

Bus/HOV Site Serviceable Planning

Traditional suburban development results in long, unsheltered walks to bus stops, and circuitous bus routes that delay passengers and contribute to high operating costs.

Typical post-war single family neighborhoods require long walks to bus stops on arterials, usually because the lack of pedestrian easements requires walkers to follow cul-de-sacs and curvilinear streets rather than direct routes.

Multifamily buildings are frequently set back behind parking lots units without covered walks to bus stops.

Shopping mall sites typically have the buildings set back from the main road to make room for a large parking apron, which bus passengers must cross without shelter from weather or protection from cars.

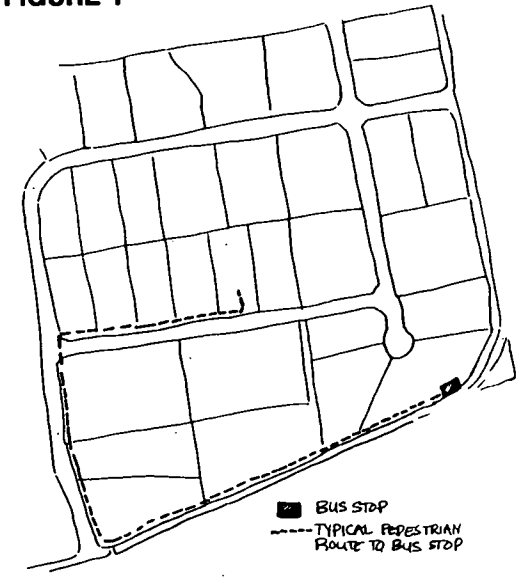
Bus access for public transit is frequently denied by mall owners.

- Pedestrians frequently feel exposed to vehicles while crossing the parking apron, since there is no defined pedestrian path.

Office and industrial parks have typically low density buildings set back behind parking and scattered along a loop road.

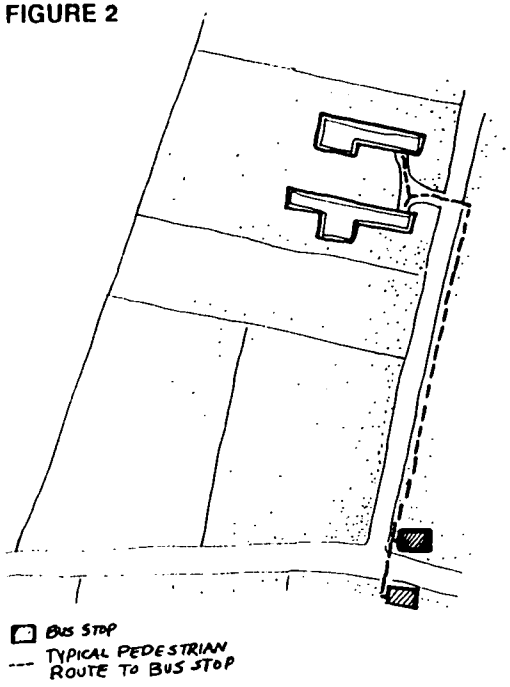
- Bus passengers must walk long distances to arterials usually without sidewalks or shelter, or bus stops.
- Buses must make detours on access roads and stops at each building, increasing operating costs and lengthening trips for other passengers.

FIGURE 1



Single-Family Neighborhood With Poor Access To Bus Stop

FIGURE 2



Elderly Housing Off Main Route

FIGURE 3

Wheaton Plaza tells public buses: Hit the road

By MATT HAMBLEN
Journal staff writer

Metro and Ride-On buses will not stop on Wheaton Plaza property after today — much to the chagrin of county transportation officials.

Wheaton Plaza officials "are throwing our buses off the mall," county Transportation Director Robert McGarry said in an interview this week.

"They don't want our bus customers using their bathrooms, they say they dirty up the stores and wait in front of the stores," McGarry said.

"They're almost saying, 'We want rich folks with cars to come and shop and workers can get there on their own,' " he said. "And then they (mall officials) complain they can't get people to work at the mall."

About 5,000 Metro and Ride-On passengers alight and board buses each day at Wheaton Plaza, said Genny Leary, county director of transit service development and promotion. As many as 1,250 are considered mall customers, she said.

"They're almost saying, 'We want rich folks with cars to come and shop.'"
— Robert McGarry

Mall officials could not be reached for comment on the removal of the two major bus stops. But a spokeswoman for Woodward & Lothrop, with a store next to the stops, said the mall was relocating a ring road due to mall expansion that would conflict with bus traffic.

Several bus passengers waiting at the stops yesterday were unaware of the change, and most of those interviewed were upset when told about the plan.

"I had no idea," Dorothy Smith of Hyattsville said. "This is convenient to come into the Wheaton Plaza."

Smith said she uses both Metro and Ride-On to get to her job.

Mattie Suttle of Silver Spring wondered how she would get to the center. "Why are they doing this?" Suttle said. "If they close down the stop, they should close the mall down. We depend on these buses. I think it's stupid. It's messing us all up."

A hand-lettered sign on both stops east of Woodward & Lothrop said Metro passengers would be able to catch buses off mall property along Veirs Mill Road or University Boulevard.

McGarry said Ride-On passengers would be able to catch buses on Veirs Mill starting tomorrow.

Chet and Claire Mackiewicz of Kensington said they regularly use the buses that stop at the mall, but felt the change in stops would not be an inconvenience.

"It's not that far," Chet Mackiewicz said.

But McGarry said it would be a "hell of a long way" for older passengers who would have to walk hundreds of yards from the new bus stops to the mall, possibly in rain or snow.

Gordon Aoyagi, the county's chief of transit services, said a mall official gave the mall's construction of the ring road as the main reason for closing the bus stops, but the mall official also suggested it was retaliation for

Please see WHEATON, A4

Newspaper Clipping Describing Cancellation of Bus Access to Shopping Mall

Mall tells Ride-On and Metro to buzz off

WHEATON from A1

encountering construction delays with county building inspectors.

The county only learned of the close-down last Friday, and hardly had a chance to inform passengers, Aoyagi said.

"I'm sure the phone will ring off the hook on Monday and bus passengers will blame us," Leary said. "But it's private property and we don't have control over the situation."

McGarry said Montgomery Mall is threatening to stop public buses entering the mall, but nothing definite has been decided. Mall officials could not be reached for comment.

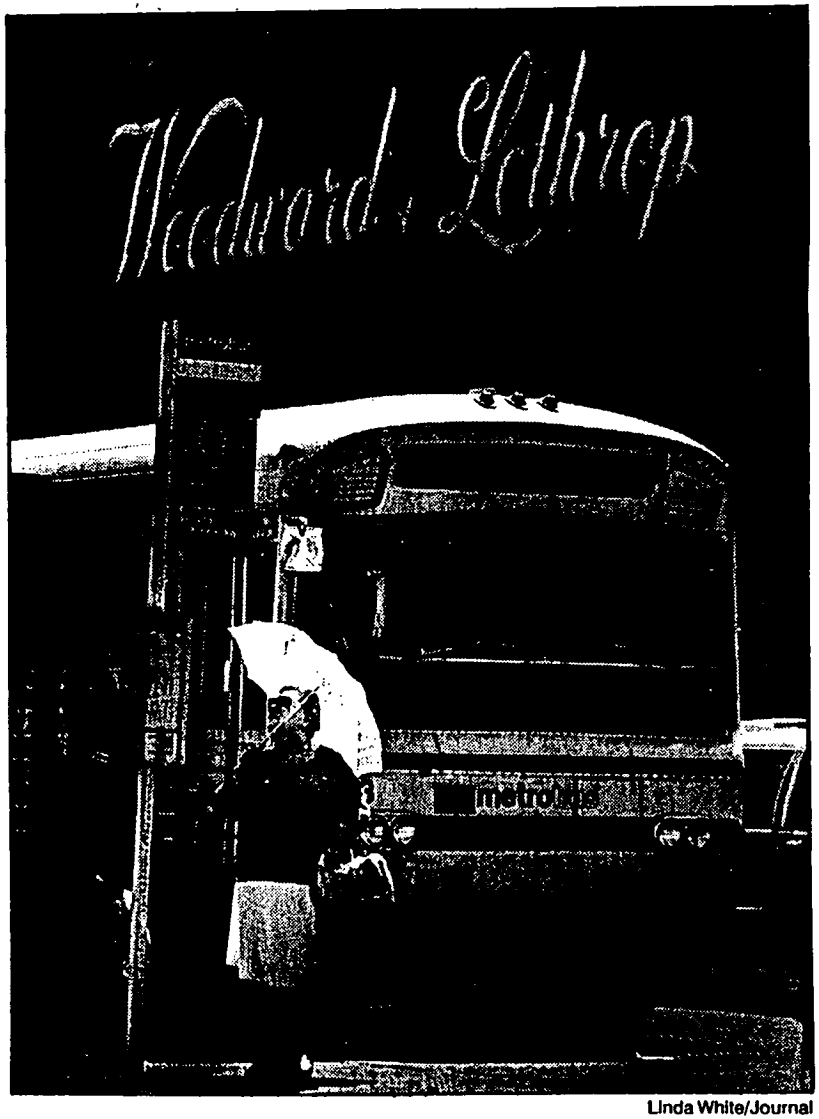
About 200 buses stop each day outside Sears at Montgomery Mall, creating an expense to Sears for cleaning up after passengers and for repairs to pavement designed for cars, Sears Operating Manager Frank Pokorny said.

"We value every customer from buses, but those customers don't just stop at one store," Pokorny said. He is seeking possibly a relocation of the stop, which has been in front of Sears for 12 years, or sharing of the costs of cleanup and repairs with bus operators and other stores.

"We're not demanding service be stopped; we're asking for alternatives," Pokorny said.

Lakeforest Mall ended public bus stops on its property several years ago, while White Flint never allowed public bus stops, officials said.

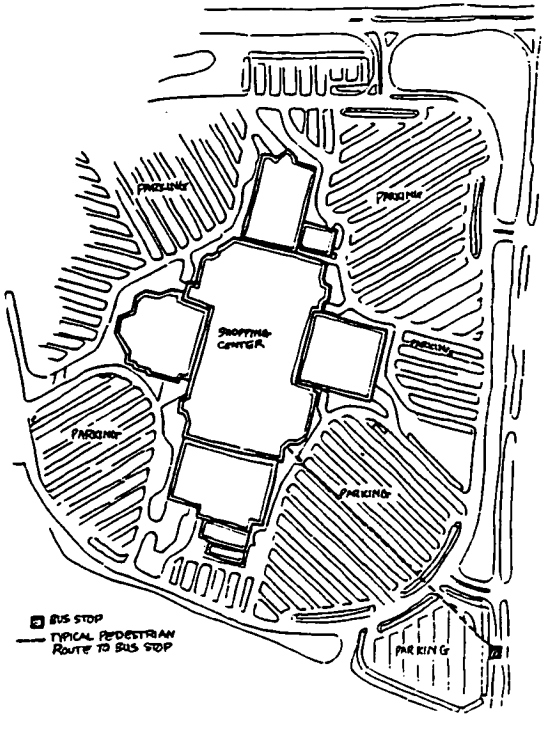
Metro routes involved at Wheaton Plaza are C2, L6, L7, Q2, Q4, Y4, Y5, Y6, and Y8. Ride-On routes are 6,8,9,34,35, and 38.



Linda White/Journal

Patrons of the Wheaton Plaza bus stop check out signs showing revised bus routing. Wheaton Plaza has banned buses.

FIGURE 4



Shopping Mall with Long Exposed Walk to Bus Stop

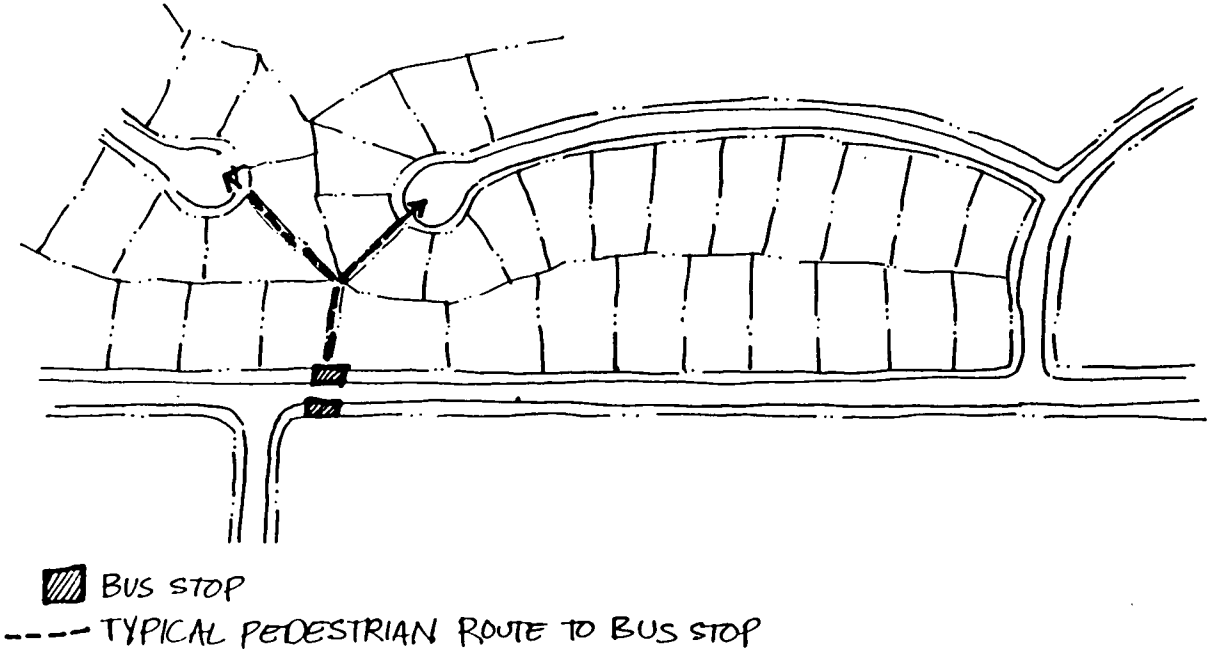
Often connections are not made between developments so that a bus serving a development must return to an arterial before entering an adjacent development, which lengthens routes or makes service impractical.

Since HOVs often have the same problems as buses as they pick-up and drop-off members site planning problems that make bus usage unattractive often make HOV usage unattractive.

Bus/HOV serviceable site planning would produce shorter, sheltered walks to the bus, faster bus trips, and lower bus operating costs.

In single family neighborhoods, pedestrian easements that provide direct access to bus stops on arterials should be required.

FIGURE 5



Single Family Neighborhood With Good Access

Multi-family buildings should be located close to the street with covered walkways leading directly to bus stops.

Shopping malls should be required to permit bus access to entrances, or to locate an entrances adjacent to bus stops.

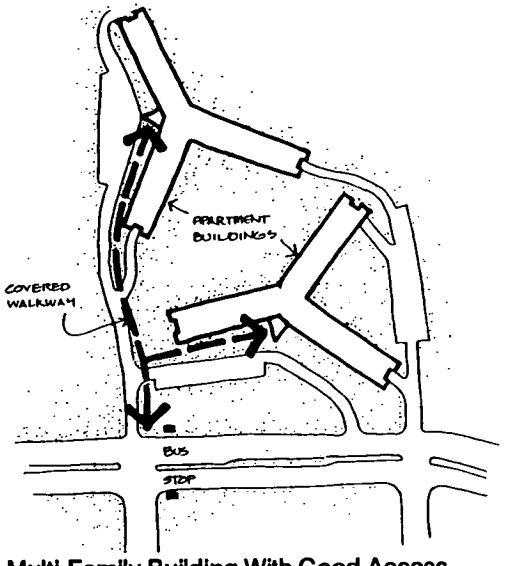
- Bus access should require minimum time off the road, and should be to a sheltered entryway.
- Entrances located adjacent to a bus stop should be at the lot line and provide covered shelter from the bus to the mall.

Office and industrial parks should place parking behind buildings, and front entrances should either be clustered next to bus stops on arterials, or clustered next to bus stops on loop roads.

- Covered walkways[1] should be provided between buildings and bus stops.
- Where bus stops are on loop roads, the roads should be laid out to maximize pick-ups per mile, and minimize time off arterials.
- Where size permits, office and industrial parks should require provision of on site convenience retail, child care, and restaurants, all accessed by covered walkways, to minimize the need for private cars for "errands" before and after work. (Note: Inclusion of convenience retail is now part of the guidelines for the County's I-3 zone.)

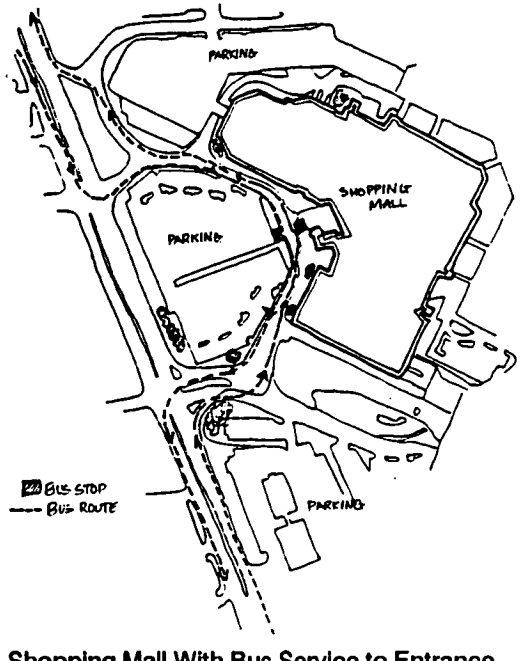
[1]Covered walkways may seem an unnecessary requirement to some observers. It should be noted, however, that the purpose of bus/HOV serviceable site planning is not only to make trips easier for people who don't use private cars. It is also to make buses and HOV vehicles compete effectively for riders in order to reduce congestion. In bad weather or hot sun, covered walkways will make buses seem very attractive to drivers who have to walk across large parking lots.

FIGURE 6



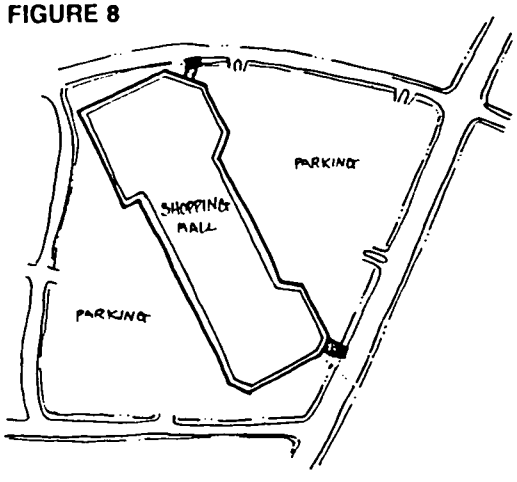
Multi-Family Building With Good Access

FIGURE 7



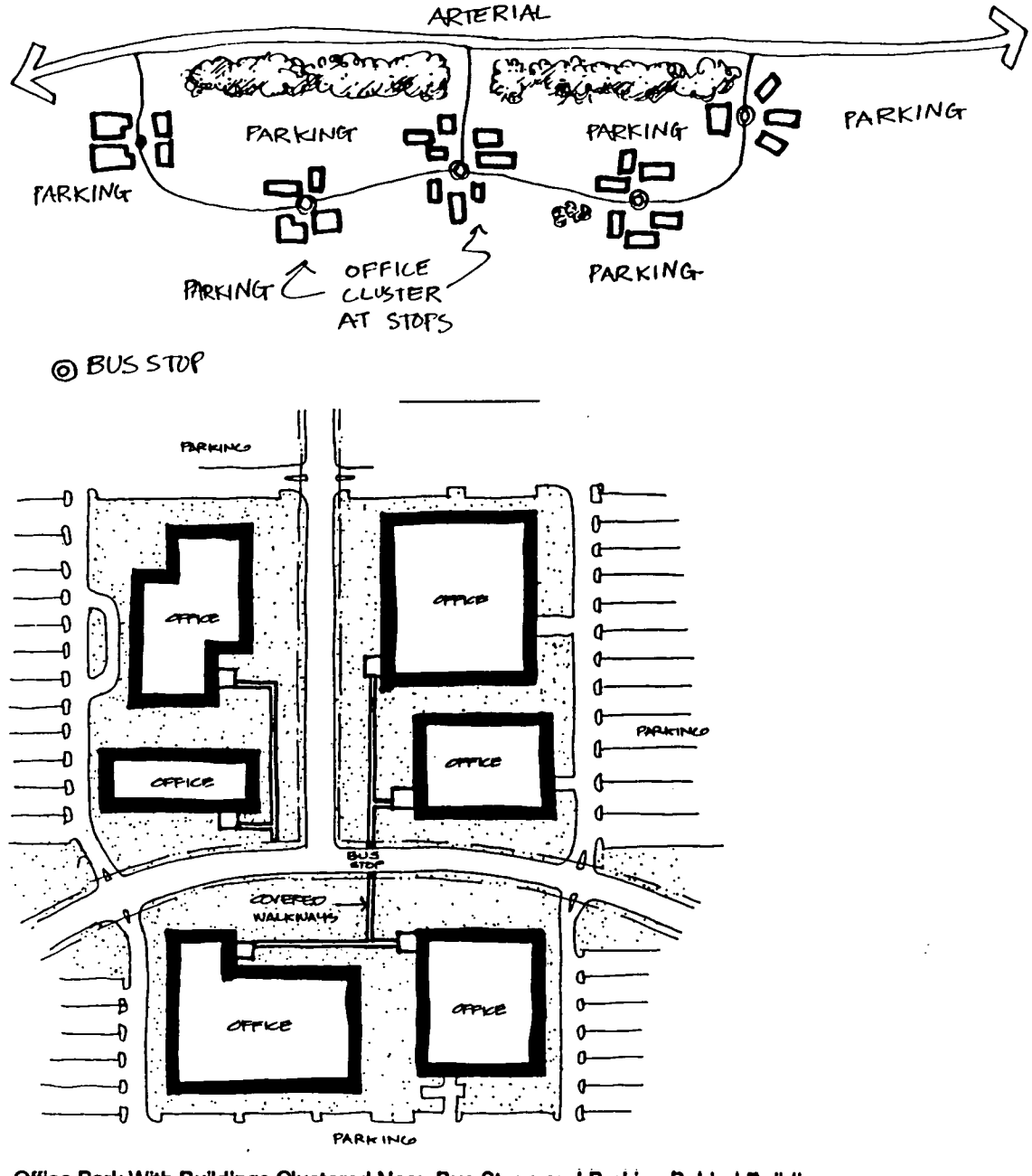
Shopping Mall With Bus Service to Entrance

FIGURE 8



Shopping Mall Entrance Next to Bus Stop on Arterial

FIGURE 9



Office Park With Buildings Clustered Near Bus Stops and Parking Behind Buildings

Bus/HOV serviceable site planning will require better advance planning for bus service, including possibly the inclusion of bus route planning in master plans.

A plan for future bus routes may be required that developers know how to plan their sites for service by bus and HOV.

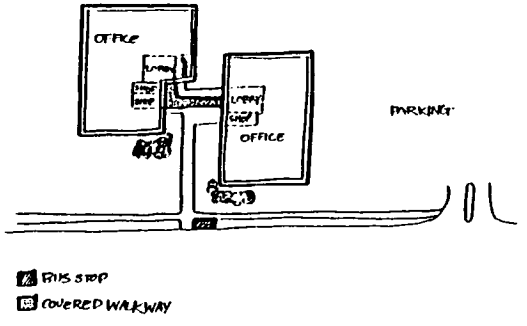
- Routes should be concentrated on roads orientated to heaviest demand to permit best headways both on and off peak.
- Routes should be designed to minimize routing changes as areas develop.

Bus service to new areas should be available at occupancy when commuting patterns are initially established.

In areas where future growth is expected but bus service is not yet available, bus/HOV serviceable site plans should be required so that use of bus and HOV is practical when it becomes available.

Efforts should be made to retrofit existing development in accordance with the principles for bus/HOV serviceable site plans laid out above.

FIGURE 10



Convenience Retail in Office Park

Appendix 6

Water, Sewer and Solid Waste Capital Costs

MEMO

THE MARYLAND-NATIONAL CAPITAL PARK AND PLANNING COMMISSION

Appendix 6

July 17, 1989

TO: Pat Hare
Planning Director's Office

FROM: Jorge A. Valladares, Chief JAV/per R.M.
Environmental Planning Division

RE: Water, Sewer and Solid Waste Capital Costs

A gross estimate of the water and sewerage system capital costs to implement the "FAST" scenario follows:

Given: Households = 600,000
Jobs = 900,000

The overall sewage treatment capacity required bi-county approximates 303.4 mgd.

Based on information contained in the County C.I.P.*, the following water and sewer system costs were obtained:

Montgomery County*

Sewer: $338.1 M
Water: $ 38.8 M

Bicounty*

Sewer: $407.2 M
Water: $ 82.9 M

Information Only*

Water and Sewer: $297.2 M

Assume: Montgomery County Share at 50% where appropriate
Bonds at 82% where appropriate
Grants at 18%
Seneca at 10 mgd
Damascus at 1.5 mgd
Rock Run at 20 mgd
Blue Plains at 370 mgd

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* Source: Montgomery County Government, "County Executive's Recommended Capital Improvements Program", FY 1990-1995, Vol. 2, p. 20-12.

Sewer Montg. Co. = [$338.1 M + 0.5 ($407.2 M)] 0.82 = $444.19 M
Water Montg. Co. = [$ 38.8 M + 0.5 ($ 82.9 M)] 0.82 = $ 65.81 M
Information Only M.C.= 0.5 * $297.2 M = $148.6 M
Total M.C. = $658.6 M

Additional M.C. Treatment capacity needed = Have it all capacity need - capacity covered in C.I.P.
= [303.4 mgd - 193.3 mgd] *0.5
= 110.1 mgd* 0.5 = 55 mgd

Cost of 55 mgd at $10 M/mgd = $550 M
Net cost with grant = $550 * 0.82 = $451 M

Total M.C. share = $658.6 M + $451 M = $1.11B

Use $1.11B

Solid Waste Costs

1. Current Programs

Resource Recovery Facility at 1800 tons/day	= $170 M
Transfer Station and Rail	= $ 30 M
Oaks Landfill Expansion	= $ 87 M
Recycling	= $ 7 M
	$294 M

2. Expansion

RRF at 2400 tons/day	= $ 80 M
Transfer Station and Rail	= $ 10 M
New Landfill	= $ 90 M
	$180 M

3. FAST Scenario

Domestic waste=1.5 tons/year/household* 600,000=900,000/tons/year
Business waste=0.7 tons/year/emp.* 900,000=630,000 tons/year
Total Load= 1.53 M tons/year

Less 30% recycling = 0.7* 1.53 = 1.071 M tons/year
RRF maximum expansion load = 2400 tons/day* 0.85 eff.* 365 days/year = 744,600 tons/year

Difference = 1,071,000 - 744,600 = 326,400 tons/year
New Plant Need=326,400 tons/year 365 days/year=894 tons/day at 85% efficiency
Design 1052 tons/day plant

New RRF Costs

Site and Structure	=	$100 M
Transport	=	$ 20 M
Landfill	=	$100 M
Transfer Station	=	$ 10 M
Recycling	=	$ 10 M
		$240 M

Total Costs 1+2+3 = $294 M + $180 M + $240 M = $715 M

Use $750 M

JAV-37:el

Appendix 7

Summary of Costs of Sprawl *Study*

The Costs of Sprawl

prepared by

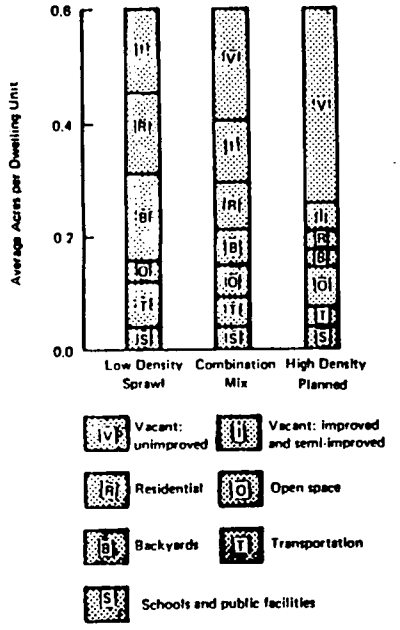
Real Estate Research Corporation

for

the Council on Environmental Quality;
the Office of Policy Development and Research,
Department of Housing and Urban Development;
the Office of Planning and Management,
Environmental Protection Agency

April 1974

LAND USE



Community Analysis

This summary refers to three of the community types analyzed: the "low density sprawl," the "combination mix," and the "high density planned" communities. They may be defined as follows:

- Low density sprawl: The entire community is made up of single family homes, 75 percent sited in a traditional grid pattern and the rest clustered. Neighborhoods are sited in a "leapfrog" pattern with little contiguity. This represents the typical pattern of suburban development.
- Combination mix: This community consists of a housing mix of 20 percent of each of the five types of dwellings, half located in planned unit developments, half in traditional subdivisions.
- High density planned: In this community, housing is composed of 40 percent high rise apartments, 30 percent walkup apartments, 20 percent townhouses, and 10 percent clustered single family homes. All of the dwelling units are clustered together into contiguous neighborhoods, much in the pattern of a high density "new community."

The following briefly summarizes the study's findings in terms of land use, economic costs, environmental costs, energy and water consumption, and some personal costs.

Land Use: Although all the communities cover the same area, over 50 percent of the land in the high density planned community remains completely undeveloped, whereas all the land is at least partially developed in the low density sprawl community. On the other hand, the low density sprawl community has more land that is improved but vacant, an indication of the amount of leapfrogging that occurs there.[2]

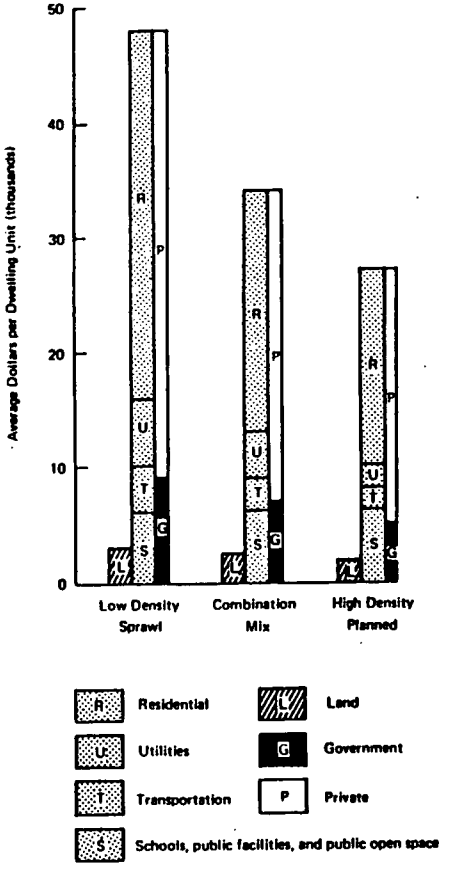
Figure I shows how these communities differ in land use. Although four times as much land is used for residential purposes in the low density sprawl community as in the high density planned community, only two-thirds as much is dedicated to public open space. However, if backyards, which are also a form of open space, are included, the low density community has twice the public and private land *dedicated* to open space as the high density community; it must be remembered, however, that in the high density planned community, over one-half of the land is not developed.

The amount of land used for schools and other public buildings is the same in all communities, but the high density community uses about half as much land for transportation as the low density community.

[2] "Improved" here means that the land has been provided with at least some infrastructure such as streets and sewers.

FIGURE II

COMMUNITY COST ANALYSIS
CAPITAL COSTS



Economic Costs: In terms of total investment costs, the high density planned community is distinctly lower: 21 percent below the combination mix community and 44 percent below the low density sprawl community. Most of these savings result from differences in development density—savings of about 3 percent of total development costs result from better "planning," whereas those from increased density amount to 41 percent.[3] The largest cost savings are in construction of residential dwellings, although important savings are attributable to reduced costs for roads and utilities, which are about 55 percent lower in the high density than in the low density community.

[3] Throughout this study "planning" is used in a very limited sense to mean increased clustering or compactness of development. Good planning includes much more than just clustering, and may well result in more significant cost savings than those indicated here.

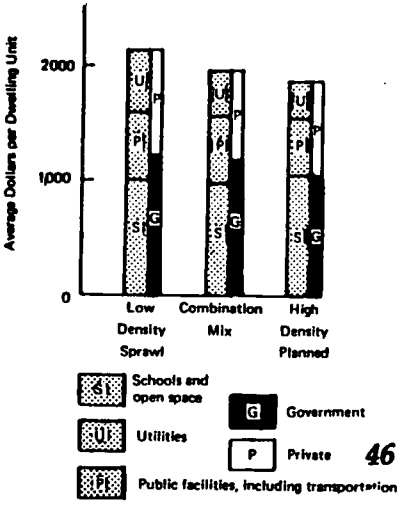
Figures II and III summarize these investment and operating costs for the three communities. The total investment costs do not include costs of the land; they are indicated separately on Figure II. The operating and maintenance costs do not include the cost of maintaining the residential structures (although the operating costs for utilities comprise a substantial portion of this cost), the financing costs for the capital investments that have been made, or the costs of operating automobiles.

Figure II also shows the difference in investment costs which are borne privately (initially by the developer) and publicly. Not only does the high density planned community cost less to construct, but a lower proportion of the costs is likely to be borne by government.

The difference in operating and maintenance costs is less noticeable than the difference in investment costs because O&M costs are related more to the population being served than to the pattern of development. However, the higher density communities are again somewhat less costly in terms of the total operating and maintenance costs and in the costs paid by government.

FIGURE III

COMMUNITY COST ANALYSIS ANNUAL
OPERATING AND MAINTENANCE COSTS



Environmental Costs: Air pollution has two major sources: automobiles and residential heating. Higher density developments require less energy for heating, and higher density and better "planned" communities stimulate less automobile use. Thus the high density planned community generates about 45 percent less air pollution than the low density sprawl community. Although "planning" has no effect upon the amount of pollution resulting from residential heating, it can reduce the amount from automobiles by 20 to 30 percent. The amounts of air pollution generated by the different communities are shown in Figure IV.

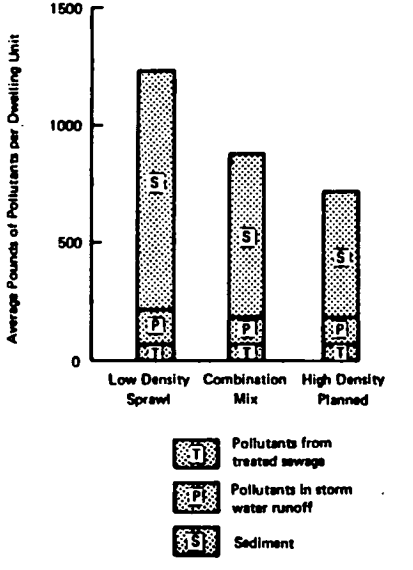
Figure V indicates a similar pattern of water pollution generated by the different development patterns. The type of development has no effect on the amount of sanitary sewage generated because this is a function only of population.[4] However, it does affect the important problems of storm water pollution and sediment. The less paved area there is, the less storm water runoff there will be. This is important not only in terms of water pollution problems but also in terms of downstream flooding. More clustered communities have somewhat less pavement than sprawl communities, but again the significant savings come from increasing density.

For both air and water pollution, it is important to note that although the higher density community generates less pollution, it does so in a smaller area, resulting in a higher amount of pollution generated per acre developed.

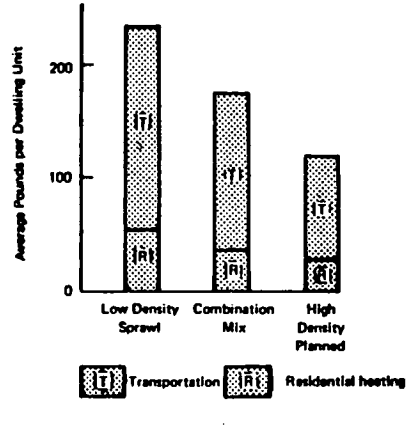
In terms of other environmental factors, planning is the key to eliminating noise problems, preserving valuable wildlife and vegetation, and creating a visually attractive development. For a given developed area, increased density allows the planner greater flexibility in accomplishing these goals. However, the increased density does concentrate noise-generating activities and puts added demands on the designer to create aesthetically pleasing developments.

[4] Sanitary sewage pollutants indicated are those remaining after tertiary treatment of the sewage. With only secondary treatment, which is more common, the volume of pollutants would be increased 5 to 10 times.

ANNUAL WATER POLLUTION GENERATION



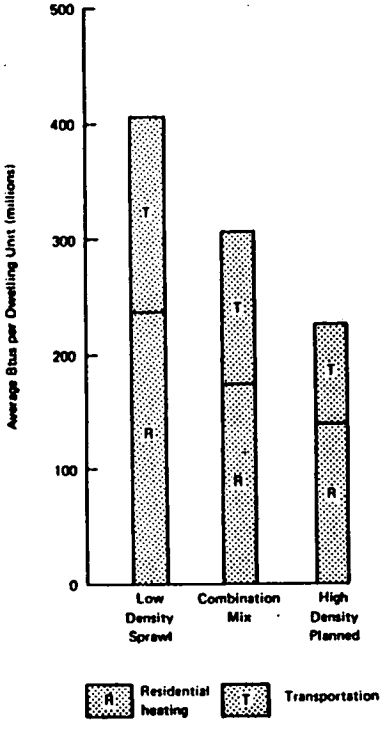
ANNUAL AIR POLLUTION EMISSIONS



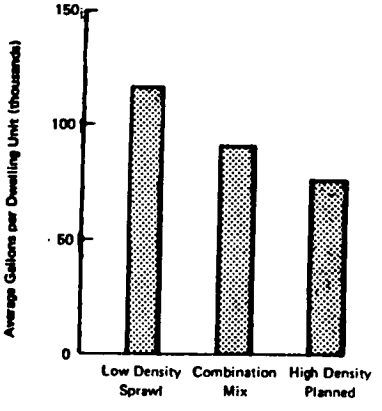
Energy and Water Use: Energy consumption is determined primarily by residential heating and air conditioning requirements and by automobile use. Heating and air conditioning requirements are related primarily to the type of dwelling unit—denser developments have lower demands than single family units. Transportation demands are affected both by the degree of clustering and community planning and by density. "Planning" alone can save nearly 14 percent of total energy consumed, but "planning" combined with increased density can save up to 44 percent.

Water consumed in cooking, drinking, etc., is not affected by either planning or density. However, water for lawn watering is affected by both. Clustering alone can save 6 percent of total water consumption, but the high density planned development can save 35 percent over low density sprawl development.

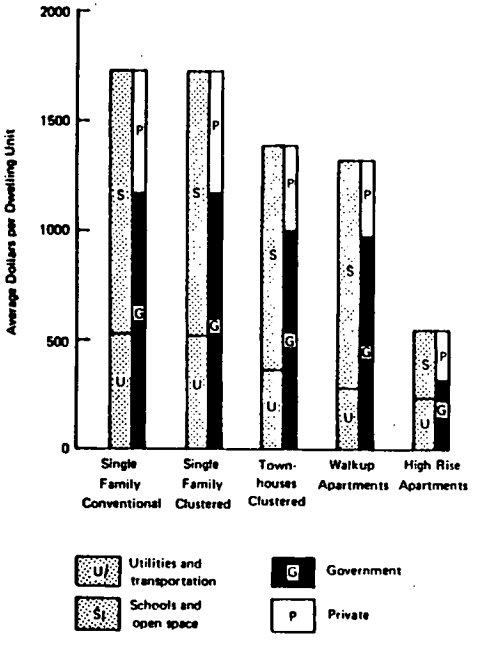
ANNUAL ENERGY CONSUMPTION



ANNUAL WATER CONSUMPTION



ANNUAL OPERATION AND MAINTENANCE COSTS



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The review and comments of the following Directors, and their staff, of the County Executive and the County Council were helpful at checkpoints during the evolution of this Study.

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Consultant Credits

Name of Firm	Nature of Work
COMSIS Richard Kuzmyak C. Y. Jeng Ron Malone Richard H. Pratt	Transportation Modeling
DeLeuw, Cather and Company Clarke Rees	Transportation Analysis and Cost Estimating
Douglas & Douglas, Inc. Bruce Douglas, Ph.D Barry Zimmer	Transportation Modeling
Greater Washington Research Ctr. George Grier	Demographic Analysis
Hammer, Siler, George Associates Elizabeth Davison	Housing Analysis
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Rivkin Associates, Inc. Malcolm and Goldie Rivkin	External Factors
Tischler & Associates, Inc. Paul Tischler	Fiscal Modeling
The Wharton School of the University of Pennsylvania Susan Wachter, Ph.D.	Housing Cost Modeling